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The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

VOL. 6 (Third Series) JULY – AUGUST, 1957 No. 4

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COVER PICTURE

The "Flowering Peach" photographed here in all the glory of its showy, pink blossoms, is a garden favourite which appears at its best in early spring. It is a relative of the commercial fruit-bearing peach tree which shows a wide range of variation in the size and shape of its blossoms

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More efficient use of

Pasture for Summer Grazing

By N. DAVENPORT, B.Sc. (Agric.), Senior Adviser, Meat Production

DURING the maturing of pasture from the flowering stage there is a considerable falling off in quality and in its overall value as stock fodder. Much of this loss in carrying capacity can be avoided by mowing the pasture at the hay stage and leaving the cut material in the paddock for grazing over the summer months. This is a very practical possibility in view of our long dry summer. Such a practice is of course in addition to providing adequate stored reserves of meadow hay for normal autumn and early winter feeding.

The establishment and efficient use of improved pasture is an important aspect of farm husbandry in our cereal and sheep raising areas. Because of the type of climate experienced in these areas—a well defined winter rainfall period followed by a comparatively long summer drought of up to six months—pastures are of the annual type. Perennial species are not generally suited to these conditions. The basic pasture species is subterranean clover (*Trifolium subterraneum*). It is commonly associated with Wimmera ryegrass (*Lolium rigidum*) and generally with many volunteer species. These are principally brome grass (*Bromus* spp.), barley grass (*Hordeum murinum*), capeweed (*Artotheca calendula*), wild geranium (*Erodium botrys*), silver grass (*Vulpia* spp.) and the so-called native clovers the most common of which are cluster clover (*T. Glomeratum*), hop clover (*T. campestre*) and woolly clover (*T. tomentosum*).

The growing season of the agricultural areas lengthens progressively from north to south ranging from five and a half months in the Geraldton area to seven or seven and a half months in the districts adjacent to the southern coast. The early variety of subterranean clover—Dwalganup—is by far the principal legume used in the production of improved pastures in all sheep raising districts where rainfall is sufficient for the development of such pastures, except in the southern areas where the heavier rainfall and longer growing season enables the more productive midseason varieties to be grown (see map).

These annual pastures have a familiar and typical pattern of growth. Following germination, production is at a low level, particularly in cold winters but, as the season advances, the growth rate increases progressively until in the spring it is at a very rapid rate indeed and considerably in excess of the requirements of the stock numbers. It is this excess spring growth which provides most of the paddock feed over the summer months. After meadow hay requirements have been cut, the remainder is left to mature and dry off.

The level of production from stock is largely dependent upon the quality of the pastures throughout the year and quality is determined primarily by the protein

Fig. 1.—Map showing early and midseason subterranean clover areas.

content. Protein is essential for body maintenance and for the production of meat, milk and wool. The protein content of pasture varies considerably according to its stage of growth. In young plants, it is very high (on a dry matter basis) and often in excess of the animals' actual requirements. Protein levels decrease progressively to the flowering stage when a balanced pasture is still well suited for growth and production. However, considerable changes occur from then on to the mature dry state. The protein content falls both in quantity and quality, the plants become more fibrous and the nutrients less digestible, all of which results in an appreciable decrease in food value.

The importance of quality in dry paddock grazing was emphasised in experi-

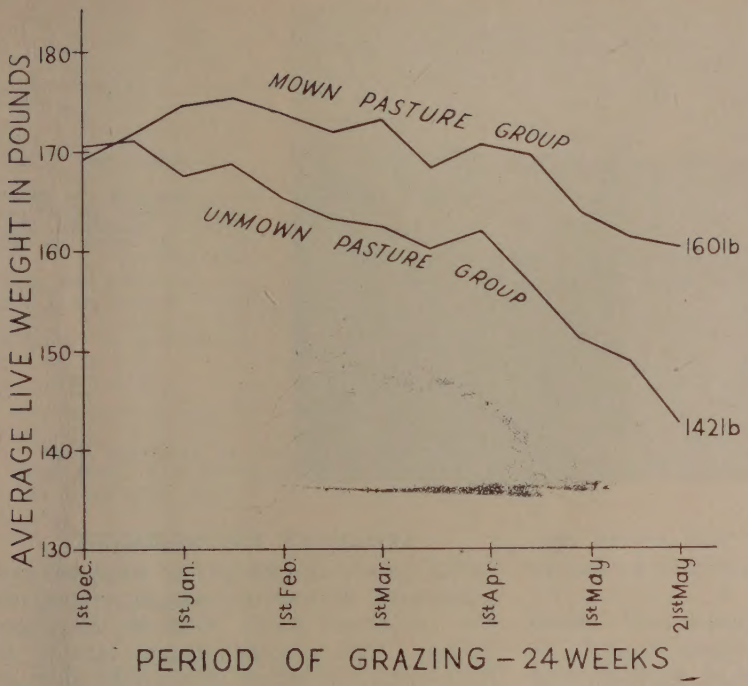

Fig. 2.—Graph showing live-weight trends of sheep in each group. Avondale experiment 1953-54.

mental work carried out at the Wongan Hills Research Station on areas of top-dressed natural pasture with a negligible clover content. Merino wethers steadily lost weight to starvation level on this pasture over the summer despite ample quantities being available. The loss of condition was due solely to the poor

Average Monthly Rainfalls and Maximum and Minimum Temperatures for these Stations are shown below.

Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Avondale.													
Rainfall (pts.)	22	56	81	90	216	314	295	228	104	81	51	35	1,571
*Temperature—													
Mean Max. (°F.)....	91·8	91·0	85·7	78·5	69·2	63·2	61·8	63·8	68·4	73·4	82·5	88·9	76·5
Mean Min. (°F.)	60·9	61·3	57·7	51·7	46·4	43·3	41·3	41·7	43·6	46·5	53·1	58·4	50·5
Chapman.													
Rainfall (pts.)	24	44	62	79	235	404	386	262	140	90	39	24	1,789
Temperature—													
Mean Max. (°F.)....	92·8	92·8	89·2	83·3	73·9	67·6	65·4	66·7	71·7	76·6	84·4	89·3	79·5
Mean Min. (°F.)	63·6	64·2	62·2	57·8	51·7	48·1	45·4	45·6	47·1	50·0	56·4	60·5	54·4
Wongan Hills.													
Rainfall (pts.)	36	52	86	94	189	251	256	200	93	69	41	36	1,403
Temperature—													
Mean Max. (°F.)....	92·7	90·4	87·9	78·4	67·2	62·4	60·4	61·9	68·6	73·5	80·2	85·6	75·7
Mean Min. (°F.)....	63·1	62·9	61·1	55·5	48·5	45·2	41·8	41·7	45·6	47·9	52·0	57·1	51·9

* Data for York, 20 miles north, the nearest official temperature recording station.

Fig. 3.—Sheep on the "mown and fed back" plot of the Avondale experiment 1955-56. A hay ration has just been distributed.

quality of the grazing. The protein content was below the level required even for maintenance.

For the efficient utilisation of excess spring growth, it is necessary to avoid, as far as possible, the loss of feeding value which occurs from flowering to maturity. It can be done very effectively of course by converting the pasture into meadow hay. This is the accepted practice for providing fodder reserves for the late autumn early winter period. However, this usually accounts for only part of the surplus spring growth. The remainder is left to mature normally for use as paddock grazing over the summer. It can be made into hay but instead of incurring the expense of baling, storing and feeding back, can be left in the paddock either as cut or in windrows. This is a comparatively inexpensive method of making more efficient use of the excess spring growth above normal hay requirements by providing paddock grazing of better nutritional value for the summer months.

In order to determine to what extent such a practice may improve production per acre, a series of grazing experiments with sheep were conducted at the research stations at Avondale near Beverley, Chapman in the Geraldton area and Wongan Hills, three miles north of the town of Wongan Hills. These three stations are all situated in the early subterranean clover areas.

AVONDALE EXPERIMENTS

The Avondale Station is situated five miles west of Beverley and is typical of the red-brown earth soils of the Avon Valley. The average annual rainfall is 15.71 inches, of which 10.58 inches falls in the growing period, May to October inclusive.

1953-54 Experiment.

A uniform area of 20 acres was selected carrying a subterranean clover-Wimmera ryegrass pasture with a small admixture of volunteer species, principally capeweed, brome grasses, barley grass, native clovers and silver grass. This area was subdivided into two plots one of which was mown at the hay stage and windrowed and the other left to mature normally. The mown section yielded 24 cwt. meadow hay per acre. Subsequent to mowing and until grazing was terminated 119 points of rain were recorded on nine days with the maximum fall of 41 points on April 23.

On December 2, 1953, each plot was stocked with 40 unmated fullmouth crossbred ewes (4 sheep per acre) in fat condition. Grazing was terminated on May 21 (24 weeks). Both groups were then removed from the area and run as one flock until shearing when individual woolweights were recorded.

The results are as follow:—

AVONDALE RESEARCH STATION.

Summer Grazing Experiments, 1953–54.

Body weight trends and wool yields.

Plot Treatment.	Average Weight of Sheep at—		Average Loss in Weight.	Average Wool Yield per Sheep.	Increased Wool Yield Due to Mowing.	
	Dec. 2, 1953.	May 21, 1954.			Per Sheep.	Per Acre.
	lb.	lb.	lb.	lb.	lb.	lb.
Mown and Windrowed	169·1	160·1	9·0	8·4	0·6	2·4
Not Mown, matured normally.	170·6	142·6	28·0	7·8		
Difference for significance—						
At 5% level	....	....	....	....	0·48	....
At 1% level	....	....	4·7	....	0·64	..

The difference in body weight losses between the groups is statistically significant at 1 per cent. level. The increased wool yield is significant at 5 per cent. level but just fails to reach the 1 per cent. level.

The sheep were weighed weekly. Body weight changes are shown in the accompanying graph.

The "mown" group increased in weight for about six weeks and then declined for a final loss of 9 lb., finishing in good to fat condition. The "unmown" group lost weight throughout the period and at the end were 28 lb. lighter than at the commencement of the experiment and in store condition only.

The most important result of this experiment however was obviously the higher quality of the mown pasture as reflected in the wool yields. The mown plot yielded 2.4 lb. of wool per acre more than the unmown plot.

1955-56 Experiment.

In order to obtain information on the relative carrying capacities of mown and unmown pasture, the above experiment was repeated during the summer of 1955/56, except that the hay on the mown area was not left as grazing but was baled and fed back at rates adjusted periodically to keep both groups at similar weights. It was expected that there would be a surplus of hay at the end of the grazing period and as the liveweight changes of both groups would be similar, the amount of this surplus hay could be interpreted as an indication of the extent of the increased carrying capacity due to mowing.

A uniform area of eight acres of pasture was selected and divided into two plots each of four acres. The pasture consisted of early subterranean clover and volunteer species, principally brome grass, barley grass, wild geranium and capeweed. One plot was mown and the hay baled and stored; the other was left to mature and dry off. The hay yield was 20 cwt. per acre and when baled contained 13.2 per cent. crude protein (dry basis). 159 points of rain fell on nine wet days during the three weeks between mowing and baling. Subsequent to baling, to the end of the grazing period, 104 points of rain were recorded on seven days, the maximum registration being 39 points on April 12.

Each plot was stocked with 24 unmated full mouth crossbred ewes (6 sheep per acre) on December 26, 1955, and grazing ceased on May 1, 1956, after a period of 18 weeks. The sheep were maintained at similar weights throughout. After the experimental grazing period they were removed and run as one flock until shearing time when individual wool weights were taken.

The results are as follows:—

AVONDALE RESEARCH STATION.

Summer Grazing Experiment, 1955–56.

Wool yields and consumption of hay data of two groups with similar body weight trends.

Plot Treatment.	Average Weight of Sheep at—		Hay Baled per Acre.	Hay Fed per Acre.	Surplus Hay per Acre.	Average Wool Yield per Sheep.	Increased Wool Yield Due to Mowing.	
	Dec. 26, 1955.	May 1, 1956.					Per Sheep.	Per Acre.
	lb.	lb.	cwt.	cwt.	cwt.	lb.	lb.	lb.
Mown, Baled and Fed Back....	144·0	134·1	20	14	6	9·8	0·5	3·0
Not Mown, Matured Normally	143·8	135·0	....	....	....	9·3	....	....
Difference for significance— At 5% level	....	....	....	....	....	....	0·84	....

The difference in wool yields between the two groups, though substantial, is not statistically significant because of a wide variation in fleece weight between individual sheep (crossbreds).

These results confirmed those of the previous experiment in that the higher quality of the hay compared with the normally matured pasture, resulted in the production of 3 lb. per acre of wool more than from the area which had not been mown.

At the end of the grazing period there was a surplus of 6 cwts. of hay per acre. Assuming that a crossbred sheep may eat up to 4 lb. of hay per day, even at this higher amount, 6 cwts. of hay represents an increase in the carrying capacity of the mown area of over one sheep per acre during the summer grazing period.

CHAPMAN EXPERIMENT

The Chapman Station is situated approximately 25 miles north-east of Geraldton in the Chapman Valley, and records an average annual rainfall of 17.89 inches, 15.17 inches of which falls in the growing period May to October.

For the experiment which was conducted at this Station during the summer of 1955/56 a uniform area of eight acres of high-yielding, well-balanced pasture was selected and subdivided into two plots each of four acres. The pasture consisted of early subterranean clover associated with volunteer species, principally brome

Fig. 4.—Mown pasture in windrows for summer grazing in situ at the Avondale Research Station 1955-56.

grasses and capeweed. The soil of the experimental block is a deep friable aluvium formed by flooding of the Chapman River. One plot was mown and windrowed and the other left to mature normally. The yield of meadow hay was 35 cwts. per acre, and it contained 9.7 per cent, total crude protein (dry basis.)

The hay matured under good conditions but before grazing commenced, two inches of rain fell on 12 wet days. During the grazing period, a further two inches were recorded again on 12 days, the highest recording being 77 points on March 4. These summer rains were above average registrations at this station, the average for which is 2.72 inches (November-April inclusive.)

Each plot was stocked with 20 unmated full mouth crossbreds ewes (5 sheep per acre) on December 6, 1955. After grazing for 22 weeks both groups were removed on May 7, 1956, and run as one flock until shearing time. Individual wool weights were obtained.

The results are shown in the following table.

CHAPMAN RESEARCH STATION.
Summer Grazing Experiment, 1955–56.
Body weight trends and wool yields.

Plot Treatment.	Average Weight of Sheep at—		Average Gain in Weight.	Average Wool Yield per Sheep.	Increased Wool Yield Due to Mowing.	
	Dec. 5, 1955.	May 7, 1956.			Per Sheep.	Per Acre.
	lb.	lb.	lb.	lb.	lb.	lb.
Mown and Windrowed	145·5	153·9	8·4	9·6	0·6	3·0
Not Mown, Matured Normally	143·7	144·8	1·1	9·0	....	....
Difference for significance—						
At 5% level	....	....	....	....	0·61	....
At 1% level	....	....	6·05	....	....	....

The difference between group wool yields is not significant. There was wide variation between the fleece weights of individual sheep (Crossbreds). The difference in weight increases is significant at 1 per cent. level.

The results of this experiment confirm those of the similar experiment carried out at Avondale in 1953/54. Here also the higher quality of the grazing on the mown area resulted in an appreciable increase (3 lb.) in wool production per acre and the average bodyweight of the sheep on this plot had increased 8.4 lb. by the end of the grazing period while those on the unmown area increased very slightly (1.1 lb.) The commencement of the winter rains terminated the differential grazing period, and at the end there was excess grazing on both plots. It is felt that an increase in the stocking rate to at least seven sheep per acre on such a high-yielding pasture would have resulted in greater wool production per acre while still allowing the sheep on the unmown area to be maintained in a satisfactory condition.

WONGAN HILLS EXPERIMENT

The Wongan Hills Station is situated three miles north of the Wongan Hills township on the present eastern fringe of the early subterranean clover areas and has an average annual rainfall of 14.03 inches, 10.58 inches of which falls in the growing period May-October inclusive. The soils are typical of the light lands of the agricultural areas and are sandy types overlying clay, with or without lateritic gravel at varying shallow depths.

No data is available as to the relative losses in the ultimate feeding value of stored hay and hay left as cut in the paddock. In order to obtain information on this aspect of pasture utilisation, a further plot was included in the experiment which was conducted at this station during the summer of 1955/56, the hay

from which was stored and fed back evenly throughout the grazing period. Thus there were three treatments, viz:—

(a) mown, stacked and fed back throughout the grazing period;

(b) mown and left in the paddock;

(c) unmown—matured normally.

A uniform area of six acres of pasture was selected consisting of early subterranean clover and volunteer species, principally brome grasses, capeweed and barley grass. It was sub-divided into three equal plots of two acres, each of which received one of the above treatments. The pasture yielded 25 cwts. per acre of meadow hay. One hundred and forty-one points of rain fell on six days prior to carting the hay from the stored hay plot but after it had been cocked. For the remainder of the period until grazing ended, 171 points were recorded.

Each area was stocked with 12 full-mouth merino wethers (6 sheep per acre) during the period December 28, 1955 to May 4, 1956 (18 weeks). In conformity with the experiments at Avondale and Chapman, the sheep were grouped as one flock after the differential grazing period until shearing time when individual wool weights were obtained here also.

The results are as follows:—

WONGAN HILLS RESEARCH STATION.
Summer Grazing Experiment, 1955–56.
Body weight trends and wool yields.

Plot Treatment.	Average Weight of Sheep at—		Average Loss in Weight.	Average Wool Yield per Sheep.	Increased Wool Yield Due to Mowing.	
	Dec. 28, 1955.	May 4, 1956.			Per Sheep.	Per Acre.
	lb.	lb.	lb.	lb.	lb.	lb.
Mown, Stacked and Fed Back	128·1	123·3	4·8	12·8	1·8	10·8
Mown and Left	130·4	117·8	12·6	12·5	1·5	9·0
Not Mown, Matured Normally	129·6	111·1	18·5	11·0	...	....
Difference for significance—						
At 5% level	....	....	6·87	....	1·10	....
At 1% level	....	....	9·26	....	1·49	....

The increased wool yields for both mown groups are statistically significant at 1 per cent. level but are not different from each other. The weight loss of the mown and fed back group is significantly less than the mown group (5 per cent. level) and the not mown group (1 per cent. level).

The difference in weight losses between the mown and left and the not mown groups is not significant due to the small number of animals involved. At Chapman and Avondale with larger numbers, the differences were highly significant.

As the plots were later seen to be understocked, six extra sheep were run in each plot during the last four weeks of the differential grazing period. The body weights and wool returns of these extra sheep are not included in the above table.

At the commencement of grazing, all sheep were in very good condition. Comparative weight trends conform with other trials. The effect on the wool yields of Merino wethers by grazing on mown pasture was considerable and amounted to 10.8 lb. and 9.0 lb. per acre respectively more than from the unmown plot. In this experiment also, the higher feed value of the mown areas maintained the sheep at heavier weights than where the pasture was not mown. The sheep on the "mown and fed" plot, at the end of the grazing period weighed 7.8 lb. heavier than those on the "mown and left" plot. This difference may have been due in some degree to rain damage of the hay on the latter plot. There was also a difference of 1.8 lb. of wool per acre in favour of the group to which the hay was fed back.

DISCUSSION

The results of the investigations at three research stations show that increased wool yields and higher carrying capacity per acre were obtained by graz-

ing sheep over the summer months on pasture which had been mown at the hay stage instead of allowing it to mature and dry off naturally. This practice of providing mown grazing, results in a fodder which has a higher protein content, is less fibrous, has greater digestibility and is decidely more palatable than normally matured pasture. It is reasonable to assume that the greater palatability induces a higher intake than the unmown grazing and could account for some part of the increased returns. Analyses of samples of the meadow hay and the dry matured pastures cut at mower height, showed that the total crude protein of the hay was consistently 30 per cent. higher than that of the mature pasture.

An essential of efficient stock husbandry is the provision of conserved fodder for feeding during the autumn and early winter months and at any other times of nutritional stress. It is necessary therefore, that ample stored hay should be provided. It is after these supplies have been ensured that the practice of mowing suitable pastures for summer grazing has its place.

Quite apart from the aspect of higher carrying capacity and considering wool yields alone, with wool at 7s. per lb. and mowing at 10s. per acre, in every experiment the value of the increase in wool yield was greater than the cost of mowing.

Although the experiments did not allow of direct comparison of costs between mowing and windrowing and mowing and leaving as cut, it is doubtful from the experiences at both Avondale and Chapman, whether the cost of this additional operation is justified. This would certainly be the case with lighter-yielding paddocks which have been grazed for most of the season and not shut up, in contrast to those from which the stock have been withheld in preparation for hay-making. It is on such lighter-yielding areas that this general procedure of pasture utilisation is likely to be followed on an extensive scale. It is considered that continuing with the mower is preferable to taking time off to rake into windrows. The question of whether to windrow or not arises also with respect to rain falling during the curing period. Although the windrowed hay is more protected in that form, it dries out less readily and may become mouldy and require turning with the attendant losses, no matter how well done.

With regard to the experiment conducted at Wongan Hills, extra expense and labour were involved in the practice of mowing, storing and feeding back compared with mowing and leaving as cut. It would appear from the small increases in carrying capacity and wool yields per acre obtained by storing and feeding back that this extra expense and labour are not justified.

The results of the experiments at both Avondale and Chapman show that with the unlimited intake of good quality mown pasture grazing, crossbred ewes are maintained at too high a level of condition as a result of such ample feed conditions. Greater returns per acre can be expected if the intake is limited to avoid over-fat sheep. It will be necessary to do this by controlling the periods allowed for continuous grazing on mown pasture. The question of a high level of intake refers particularly to breeding ewes which should certainly not be at all fat and preferably be maintained in good store condition for the first two-thirds of pregnancy. For this reason, grazing on such mown pasture during this period should be controlled. During the last six to eight weeks before lambing however, the nutritional requirements of the ewe are much higher. For this period and before winter rains are expected, ample grazing on an area of good mown pasture reserved for the purpose, would be very suitable with a small grain supplement in addition.

For weaners also, the provision of mown pasture grazing for the summer months could be a very sound practice. The problem of weaner nutrition is an important one. These sheep are both growing and producing wool and to do both they require ample feed of high quality. The quality of paddock grazing is at its lowest during the summer period and if weaners are to develop satisfactorily they should be given a supplementary ration such as cereal grain or be grazed on mature grain crops reserved for that purpose. However a pasture containing a good proportion of clover and mown at the early hay stage would provide paddock grazing of high protein level, very suitable for weaners

and likely to permit of a considerable reduction in the grain ration.

Investigation of this aspect of pasture management in relation to weaner nutrition is contemplated.

Two very important aspects of mowing are its effect on pasture composition the next season and also its use for the control of objectionable weeds or less desirable pasture species. It is essential that the

Fig. 5.—General view and a close-up of the unmown plot (1955) at Wongan Hills Research Station, showing dominance of brome grasses and uneaten unnutritious grass from the previous year. Photographs taken September 3 1956

sward should not be subterranean clover dominant, principally to avoid serious infertility problems with breeding ewes. The non-clover species are thus important components of the pasture and it is generally considered that they should be maintained at the desired level of about 70 per cent. in a well developed pasture. For this reason, mowing should not be done too early, i.e., before seed setting is general in these species, otherwise the density of seed will be so reduced that the sward is likely to become clover dominant. Experience at Avondale has shown that a subterranean clover volunteer species pasture cut when the seed setting of the non-clover species was general, set sufficient seed to maintain its density and composition the following season. There was no visual difference between a similar adjacent area which had matured normally and had identical summer grazing.

Mowing for hay has shown marked effects on pasture composition at the Wongan Hills Research Station. Brome grass is a valuable component of the pasture on such soils but tends to become dominant at the expense of the subterranean clover. The two mown plots of the experiment described and which were cut rather early, showed a marked desirable reduction in the proportion of brome grasses in the sward the following year, whereas the unmown plot was not well balanced, the brome grasses were strongly dominant and the subterranean clover was reduced to an undesirable low level. Some years ago, very good control of a brome grass dominant pasture (300 acres) was obtained with the mower by "topping" the sward at the early flowering stage of the brome grass. Sheep ate the cut material readily. In the following season, the percentage of brome grass was reduced considerably and the subterranean clover content raised to a suitable level.

Brome grass and other species can become dominant to the extent of being a serious hazard to sheep and particularly to lambs during the grass seed period. It is sound management, and certainly so for efficient lamb marketing, to minimise grass seed trouble generally by providing pasture paddocks for that period which have been suitably prepared by previous grazing or mowing, or both. There were serious cases of grass seed damage to lambs last year, which showed up very plainly in the carcases of some of those killed for export.

On all the experimental plots which had been mown, it was found that the sheep grazed freely on the residual sward as well as on the hay itself, and there was an even cleaning up of these areas. On the other hand, grazing was incomplete and uneven on the unmown plots and clumps and patches of fibrous grass stems were left. While some cover of old season's growth is desirable, these residues were in excess. They developed into dense rank patches of grass the following season in which little or no clover was able to persist. Care should be taken not to overgraze mown areas. They readily become too bare unless the sheep are taken off in time.

From experience gained in these experiments, a useful estimate can be made of the carrying capacity of mown pasture during the summer period. It appears that the stocking rate for average weight crossbreds can be assessed at one sheep per 4 cwt. of hay cut, for four months. As the maintenance requirements of dry sheep are roughly proportional to their body weight, it is obvious that the carrying capacity for Merinos which have lower body weights, will be higher than for crossbreds.

For the Avondale and Chapman experiments, full-mouth crossbred ewes were used. As sheep at this age are decreasing in wool production, younger sheep may have shown higher wool yields and hence greater differences between treatments. At Wongan Hills, Merino wethers were used. The wool yields of these sheep were at a higher level than the crossbreds and also showed greater differences between the mown and unmown pastures. Merinos may therefore show to even greater advantage than crossbreds in this aspect of pasture utilisation. Further investigation on this point is contemplated.

In recent years there has been an appreciable increase in the number of beef cattle carried in association with sheep flocks. It is well known that they can deal effectively with feed, both green and dry, which has grown beyond the stage when

it is well suited to sheep. Although as yet no similar experiments have been carried out with cattle, as described here with sheep, it is evident from practice, that cattle also do better over the summer months on mown pasture (and early cut cereal crops) than when it is allowed to mature normally.

showing balanced pasture. Photographs taken September 3, 1956.

Our summer drought conditions are well suited to the leaving of mown pasture in the paddocks with expectation of little damage from rain. However, the sheep raising districts adjacent to the southern coast have a higher incidence of summer rain and a shorter dry summer period, and therefore paddock grazing is more subject to damage. In these districts, therefore, it may be advisable to leave only part in the paddocks and bale and store the remainder.

Discussion so far has dealt with the improved pasture areas but in the less favoured districts the practice could well be carried out in those favourable seasons when volunteer pastures produce well.

Where meadow hay production is possible on farms, it is recommended that the first provision is for ample supplies of baled hay with good storage. If, after these stored hay requirements have been met, there is still pasture suitable for mowing and going to seed, this should be mown and left in the paddock for summer grazing. Windrowing is unlikely to be justified but a swathe board could be used if desired at no extra cost. It is suggested that the mower should be kept going as long as is reasonable while the pasture is still green and suitable for mowing.

SUMMARY

1. Experiments conducted at three research stations, Avondale, Chapman and Wongan Hills, situated in the early subterranean clover areas, are described in which liveweight trends and wool yields have been determined by grazing sheep over the summer period on areas of improved pasture which had received the following treatments:—

(a) mown and the hay removed in bales or as loose hay and later fed back on the same area;

(b) mown and left on the area;

(c) left to mature normally.

The grazing periods of the various experiments ranged from 18 to 24 weeks.

2. The results at each station showed the same relative trends in liveweight changes and wool yields in the different treatments. Liveweight losses were higher on the unmown areas, whilst mown pasture had a higher carrying capacity than pasture which was left to mature normally.

3. Wool yields were higher from areas which had been mown. The increases ranged from 2.4 lb. to 10.8 lb. of wool per acre. In all cases, the value of the increased wool yield was greater than the cost of mowing.

4. The results of the several experiments and the practical application of mowing pasture for summer paddock grazing including the effect on subsequent botanical composition of the pasture, are discussed.

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S26W

INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

Clothes Moths, Carpet Beetles and Their Control

CLOTHES moths and carpet beetles are among the most destructive of household pests, but because of their retiring habits their presence is often overlooked until an infestation has become well established, and extensive damage has been done. Both types of insect, however, may be kept in check by periodic attention and the same control measures are effective against both beetles and moths.

CLOTHES MOTHS

There are two common species of clothes moth in this State, and although the damage done by both is almost identical the habits of the two species are somewhat different.

General Description.

The webbing clothes moth, *Tineola biselliella* (Humm.) is probably the commoner species, and is uniform buff or straw coloured. The case-bearing clothes moth, *Tinea pellionella* (L.), is slightly darker than the preceding species, and bears three rather indistinct spots on the forewings. Both species are small, insignificant moths measuring up to ½in. across the expanded wings.

Habits and Life History.

Moths may be seen flying both by day and night, but they shun the light, and are most often met with in ill-lighted and little-disturbed situations. The moths, of course, are not directly responsible for the damage done to fabrics, but are the parents of the small white caterpillars which do the actual injury.

The moths lay a hundred or more tiny white eggs on almost any kind of fabric or material of animal origin, such as wool, feathers, fur, felt, etc. The eggs hatch in about a week or more, according to the time of year, and the tiny caterpillars commence feeding. They are creamy white in colour with dark heads and measure about half an inch in length when fully fed.

The larvae of the webbing clothes moth spin a loose silken web or tunnel on the surface of the food material in which to shelter. When they are ready to pupate a silken cocoon is formed, into the walls of which may be woven little pieces of wool, grass, etc. The caterpillar stage may last from four to five weeks to several months, or even years, under very adverse conditions, so that it is quite impossible to give a definite length to the life cycle of the insect. The pupal stage may last from two to five weeks, after which the adult moths emerge to spend a brief period mating and laying eggs.

The larvae of the case-bearing clothes moth differ from the species just described in that the young caterpillars immediately spin themselves a compact covering of closely woven silk and fragments of the material on which they are feeding. The case is gradually enlarged as the insect grows, and the caterpillar lives in this

Fig. 1.—Webbing clothes moth, enlarged and natural size
(After Gibson and Twinn)

structure throughout its life, and in feeding protrudes the head and legs and drags the case about from place to place. When ready to pupate the caterpillar often strays right away from the food material and the small woven cases containing pupae may sometimes be found suspended from the bare walls or ceiling of a room.

Material Attacked.

Cotton and silk goods are not subject to attack by clothes moths, but any fabrics made from wool or fur are very attractive, as are also feathers and made-up furs. Piano felts and felt hats may, of course, be included in the list of potential foods. It has been observed that dirty garments are more readily attacked than clean materials.

CARPET BEETLES

There are several species of carpet beetles which may be met with in Western Australian homes, but the damage done by all is so similar and their life histories so much alike that the actual species concerned is of little importance.

The Australian carpet beetle, *Anthrenocerus australis* (Hope), is one of the commonest species and its life history and habits may be regarded as characteristic of the group.

General Description.

The beetle is a small rounded creature, a little over one-eighth of an inch in length. It is dark in colour with four distinct wavy white bands across the body, giving the insect a mottled appearance.

The larval or grub stage is the most destructive form of the insect, but is frequently not associated by the housewife with this beetle at all, due to a lack of knowledge of the creature's life history. The tiny grub is provided with legs and is quite active. Its general form, however, is somewhat obscured by a covering of hairs, a long tapering brush being carried at the tail end. The creature may perhaps best be described as looking rather like a minature woolly bear caterpillar.

Life History and Habits.

The carpet beetle may at times be found in large numbers in the flower garden, for the beetles are attracted by the pollen carried by many flowers. Indoors the eggs of the beetle are laid almost anywhere, but preferably on material such as wool, feathers, or fur, which will serve as food for the young.

The eggs hatch in about a fortnight, and the larvae may be active for several months according to weather conditions. As they grow the grubs shed their skins, and these empty hairy skins are one of the characteristics signs of the carpet beetle's presence.

Materials Attacked.

Practically any materials made from wool, fur or other animal products, including silk, are subject to attack. As the name carpet beetle suggests, floor coverings are among the commonest goods damaged, but clothing, etc., is also liable to attack.

Damage to nylon fabrics by carpet beetle grubs may occur but is more or less accidental. The sense of touch is of great importance in the selection of food and

Fig. 2.—Webbing clothes moth. Eggs (much enlarged) in upper circle; moths in lower circle, larvae and larval shelters on cloth (all somewhat enlarged)
(After Gibson and Twinn)

the feel of nylon fibres may stimulate feeding. Nylon cannot be digested, however, and so damage is not extensive.

CONTROL

Both the clothes moth and the carpet beetle work best in secluded spots. Patches of carpet behind big pieces of furniture such as pianos, sideboards, etc., which are rarely moved, are particularly vulnerable, and, of course, their liking for woollens which have been stored away for long periods is only too well known to all.

The first essential should be rather the prevention of damage than the control of an outbreak once it has occurred. In this direction it cannot be over-emphasised that the frequent airing, shaking, or beating of carpets, clothing, etc., in the sunshine is of the greatest importance. Where goods must be stored away and left for long periods every care should be taken to see that they are clean and free from beetles at the time of being packed. If they are wrapped in several sheets of sound paper, each sheet being folded so that the joins do not coincide, a practically insect-proof container can be formed. The wrapped goods should be packed in a sound trunk and liberally treated with naphthalene or paradichlorobenzene, about 1 lb. being sufficient for a moderate-sized trunk. For the storage of suits and blankets, cotton or plastic bags are sometimes used. A liberal dressing of naphthalene or paradichlorobenzene should be placed in the bag and special care is necessary to see that the mouth of the bag is securely fastened. Wardrobes and chests should be periodically sprayed out and insecticide dusts should be sprinkled under the paper in the bottoms of drawers and trunks.

In the case of carpets and upholstered furniture the frequent use of the vacuum cleaner will minimise the chance of damage, but where injury is noticed the liberal use of any proprietary fly spray or even plain kerosene will kill any insects contacted.

The injury to piano felt may be prevented by suspending a bag of fumigant crystals, such as naphthalene, within the instrument and keeping the lid closed.

Upholstered furniture sometimes presents an especial problem on account of the depth at which the insect may be working. Liberal dressings of fumigant

flakes pushed down behind the seat may be helpful, also the copious use of fly sprays. In some cases, however, it may be necessary to remove the fabric to effectively reach the insects.

Fig. 3.—Larval cases and damage to woollen glove by case-bearing clothes moths
(After Gibson and Twinn)

Protecting Carpets.

When wall to wall or other large areas of carpet are laid, it is advisable to thoroughly spray or dust under the carpet, paying especial attention to the edges. The portions to be covered by the quarter round or by heavy furniture such as book shelves or pianos which fit closely down to the floor, should be thoroughly saturated with a non-staining oil solution of dieldrin or DDT. Liberal dusting with these materials will also prove effective.

Naphthalene and Paradichlorobenzene.

Both these materials are repellent to carpet beetles. The fumes of the latter are released rather more quickly than are

Fig. 4.—Australian carpet beetle (adult). Actual size is indicated by the line at left

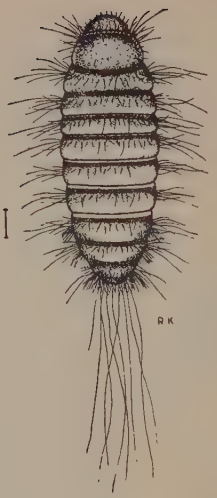

Fig. 5.—Larval stage of Austral carpet beetle (enlarged)

those of naphthalene, hence paradichlorobenzene is slightly more effective as a fumigant when it is desired to deal with an attack, but flaked naphthalene lasts longer, and hence gives a longer period of security when packed with clothes or carpets. A mixture of both is sometimes used with good effect.

Sprays.

Most kerosene fly sprays depend for their effectiveness on contact, as the concentration of DDT present is usually too low to have much residual action.

Kerosene solutions containing 3 per cent. or 4 per cent. DDT, however, will give quite effective residues. Kerosene preparations are most suitable for use indoors as there is less danger of staining but water emulsions of both DDT and dieldrin can be used where wetting is of no importance.

Dusts.

DDT and BHC dusts may be effectively used but the unpleasant odour associated with some BHC preparations limits their use in dwellings. Dusts with concentrations of 5 per cent. or more insecticide are recommended.

Turpentine.

This is an effective contact insecticide and leaves a repellent residue for some time, but may stain.

Camphor.

In a close-fitting box camphor is effective, but more expensive than naphthalene, etc.

Hot Water.

A dipping in hot water (anything over 140 deg. F.) for 10 seconds or more will kill all stages.

Insect-Proofing Chemicals.

A number of chemicals have been used with greater or lesser success to insect proof fabrics such as carpets and floor coverings. A simple and effective treatment consists of impregnating the material with sodium fluosilicate. The powder is dissolved in warm water at the rate of one ounce to the gallon, and the mixture is applied so as to gain as deep a penetration of the fabric as possible.

Dieldrin has been shown to be a most effective moth-proofing agent and proprietary mixtures suitable for treating carpets and other materials are now available. When correctly applied dieldrin will resist both washing and dry cleaning.

Recently it has been found possible to protect fabrics from clothes moth attack by altering the physical structure of the wool fibre. This change in the molecular structure of the wool makes it quite indigestible to the moth caterpillars which consequently die of starvation.

Cold Storage.

Carpet beetles and moths will not work at low temperatures and so valuable furs, etc., are sometimes kept in cool stores. Care should be taken to see that only clean furs are stored, however, as the grubs may remain dormant for long periods and then commence feeding when the fur is later brought out for use.

Fumigation.

Where necessary, trunks or even rooms may be fumigated for beetle and moth control, and carbon bisulphide, cyanide and various proprietary fumigants are suitable for this purpose. Carbon bisulphide is easily used and may be placed in a sealed trunk at the rate of about two tablespoonsful to six cubic feet. The gas, however, is explosive and inflammable, and so should not be handled indoors.

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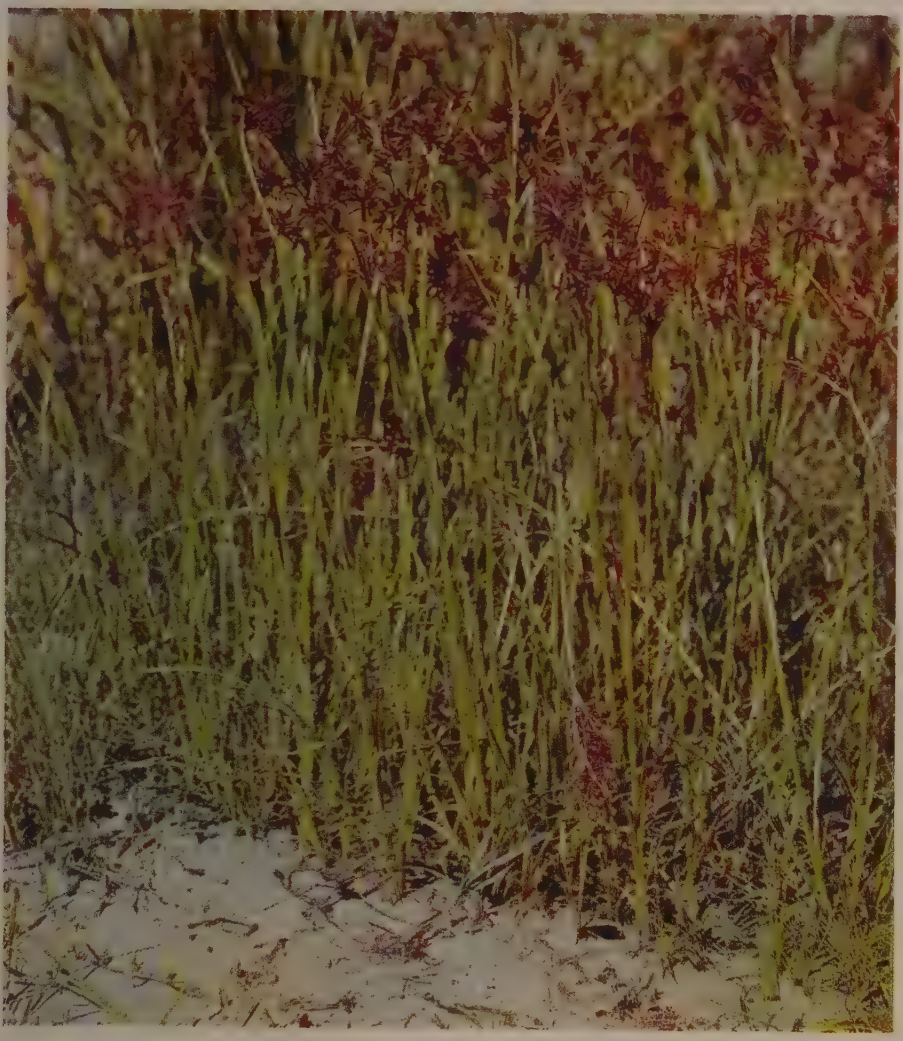


NUT GRASS

(*Cyperus rotundus* L.)

This is not a true grass but a sedge. It has negligible forage value and grows strongly in soils which retain moisture during the summer. Besides spreading by means of seeds, new plants also arise from the tubers or "nuts" formed on the roots. Spasmodic cultivation spreads rather than controls this weed.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

NUT GRASS

(*Cyperus rotundus* L.)

THE swollen tubers characteristic of Cyperus rotundus are often referred to as "nuts" and give rise to the name Nut grass. This name is also applied at times to other species of Cyperus, similar in appearance, but not producing the swollen tubers. C. rotundus is also called Java grass. Both are misnomers as the plant is, in fact, not a grass but a sedge and has none of the desirable features of the true grasses.

Members of the *Cyperus* group occur in many parts of the world, with their greatest development in tropical and sub tropical countries. A number of different species occur in Western Australia, some being native and others introduced. The subject of this article is regarded as being native to the northern parts of the State but has, with little doubt, been introduced to the South-West. The Umbrella grass causing concern in the irrigation areas is *C. Eragrostis* while several other species of somewhat less significance are found over a wide area.

Sedges favour moist soils and Nut grass is found mainly in damp situations such as along the banks of creeks and on wet flats. Irrigated land also provides favourable conditions. One of the most troublesome areas is on the fringe of Benger swamp.

DESCRIPTION

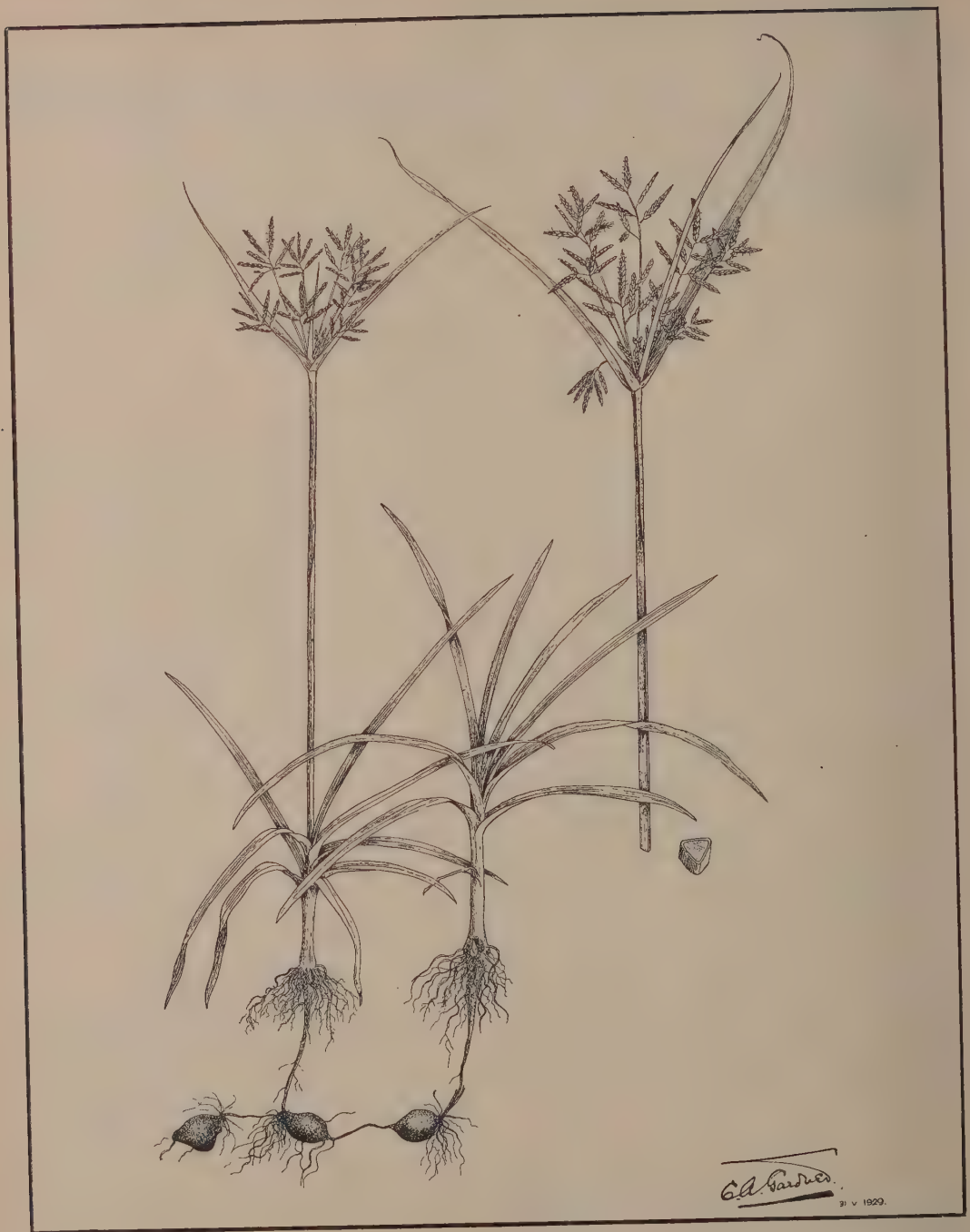
As already mentioned, "nut" refers to the hard swollen tubers associated with the root development. These are shown clearly in the pen drawing. The grass-like appearance of the sedge has given rise to the remainder of the common name.

Nut grass is a perennial plant with a creeping rhizome swelling at intervals into small tubers. The stems are slender, three angled, especially towards the top, and up to 18 inches in height. The narrow, shining grass-like leaves are shorter than the stems and have conspicuous loose sheaths. The flowers are borne in fairly dense clusters of 6-10 brown spikelets. Each spikelet is narrow and flattened, usually about one half inch long, with 12-20 florets. The nut ("seed") is three-angled and less than half the length of the enclosing glume.

SIGNIFICANCE

In Queensland several species of *Cyperus* are regarded as having forage value and for this reason some agriculturists in that State have opposed the introduction of insects with a view to the biological control of Nut grass. No species occurring in Western Australia is considered to have any value although there is a considerable difference in the weed potential of the various types.

Nut grass has all the undesirable features of a strong-rooted perennial and is well equipped for propagation. Besides



NUT GRASS.

(Cyperus rotundus L.)

producing a considerable number of seeds it is also capable of spreading vegetatively, as each tuber or "nut" can produce a new plant.

Although sometimes occurring in pastures, it is most troublesome in moist portions of orchards or on land used for vegetable and flower culture. The young leaves are eaten to a limited extent by cattle and horses but, when mature, become very fibrous. Pigs tend to root out the tubers but are not sufficiently thorough in this respect to provide an effective control measure.

It is interesting to note that the tubers are rich in starch and have been used as a food by aborigines. They are also said to yield an essential oil used by the natives of Upper India for perfuming clothes.

CONTROL

Being a weed of many countries, the control of Nut grass has been widely investigated, attention having been given to cultural, chemical and biological methods. All workers are agreed that it is one of the most difficult weeds to eradicate and there is every reason to stress the importance of preventing it from becoming established. If only a few plants are present it is worth the effort to remove them carefully by forking and, if necessary, to sieve the soil to locate all the "nuts".

The tenacity of Nut grass is indicated by American investigations which showed that, on a sandy loam soil, it was necessary to continue ploughing or discing at intervals of three weeks or less during two consecutive growing seasons before eradication was obtained. Such treatments reduced the infestation approximately 80 per cent. during the first year. Queensland workers have had similar results and regular cultivations at about fortnightly intervals for at least one year have enabled crops to be grown for three to four years without severe competition from the weed. It is important when undertaking cultural operations to treat the infected area as a unit and not work through it. Portions of the rhizome including the "nuts" are readily carried by machinery and clean parts of a paddock will soon become infested if cultivation is carried out through an affected area.

Chemicals do not provide a simple answer to the problem. Sodium chlorate and arsenicals will kill the foliage and stems but do little harm to the underground parts and new shoots soon appear. To be effective, spraying must be repeated in much the same way as cultivation. The 2,4-D herbicides, particularly the ester, give a greater degree of penetration but not to the extent of reaching all the "nuts" and several applications of at least 2 lb. acid equivalent per acre are usually necessary.

A method developed in Queensland is to cultivate the land thoroughly while the Nut grass is dormant. This breaks up the rhizomes and results in a copious growth of plants from both seeds and "nuts" when temperature and moisture conditions become favourable. Two or three weeks after emergence of the new shoots 2,4-D is applied at the rate of 2 to 3 lb. acid equivalent per acre. There is generally a substantial reduction in density of the Nut grass following the first spraying. The need for care when using 2,4-D near garden plants cannot be overstressed. Besides the risk of spray drift, there can be a residual effect in the soil for some time after treatment.

A high degree of control has been obtained with C.M.U. but at least 20 lb. per acre is required and the cost of the treatment makes it impracticable for other than small areas. Best results have been associated with two ploughings six weeks apart, each ploughing being followed by the application of 20 lb. C.M.U. per acre.

Soil fumigants are used for the control of Nut grass and, with little doubt, methyl bromide is the most effective treatment. This is applied under gas-proof covers and a good kill has been obtained, not only of the growing plants but of seeds and dormant tubers. For best results the soil should be cultivated prior to treatment to increase the depth of penetration of the methyl bromide vapour. Under favourable conditions 2 lb. of the chemical is suf-

ficient for 100 square feet. Although a practical treatment for small areas such as seed beds, the cost precludes its use for extensive infestations.

Although some attention has been given to biological methods no real progress has been made in this direction. As already mentioned there is some divergence of opinion regarding the desirability of introducing parasites, as some species of *Cyperus* are regarded as having forage value.

Pigs are fond of the tubers and, if confined on an infested patch for some time will reduce the infestation, but eradication by this means cannot be expected. Poultry penned on Nut grass also have some effect by removing the green shoots as they appear and scratching out some of the tubers.

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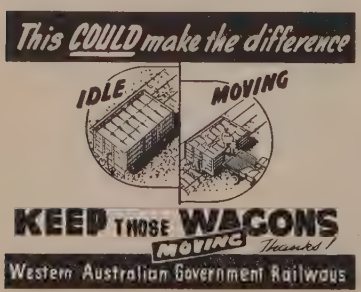

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PLANT DISEASES

APPLE MOSAIC

A Virus Disease

By H. L. HARVEY, Senior Plant Pathologist

LAST season apple growers were very conscious of a disease in their trees which was more conspicuous than usual. In fact, some orchardists say they became aware of it for the first time last season. The disease in question is apple mosaic, caused by a virus. It is sometimes known as infectious chlorosis or variegation.

The symptoms of mosaic consist of cream to white irregular markings on the leaves. They may vary from a single small spot to an almost complete whitening of the leaf. The veins of the leaves may also turn white to a greater or lesser extent. In addition, leaf scorching is often associated with the disease.

In some cases, nearly all the leaves on a mosaic-infected tree may be affected, while in others, as few as one or two leaves only betray the presence of the disease in the tree. When only one or two leaves are affected, the orchardist may not notice them and he passes the tree concerned, as healthy. It is nevertheless, diseased and in the following season may show conspicuous mosaic symptoms leaving the impression that it has only just become infected.

EFFECTS OF MOSAIC

What are the economic effects of mosaic in apple trees? The disease has been present in Western Australia for many years, but in the past it has been assumed to have had little effect on tree growth and fruit yields.

It has been noticed for some time, however, that the mosaic-affected leaves have a tendency to scorch and drop prematurely and last season this resulted in a high percentage of sunburnt fruit due to inadequate foliage protection in the heat of summer. So that even if **total** yields are not significantly reduced by mosaic the amount of sunburnt fruit that must be culled at harvest, may represent a considerable loss to orchardists.

Further information about this disease is now being sought in experiments to study tree growth, fruit yields, fruit quality and seasonal fluctuations of symptoms.

CONTROL

How can the disease be controlled? To answer this, we must first know how it is spread. Being a disease which infects the

Cream-coloured spots, blotches and veins on leaves from a single Granny Smith apple tree infected with the apple mosaic virus. The pinhead-sized spots on the first two leaves (top left) are barely discernible. The last leaf (lower right) shows severe symptoms, including necrosis or scorch. Such leaves may be partly destroyed or may drop prematurely and expose fruit to sunburning.

sap of the tree, it would be expected that it could be transmitted from tree to tree by one or more of the sap-sucking insects, or by pruning tools. This has never been proved to be the case, so that control measures directed at these possibilities cannot be guaranteed to give results.

Furthermore, there is no evidence from experimental work conducted overseas, that apple mosaic can be transmitted through the seed. The use of seedling rootstocks should therefore involve no risk of spread of the disease.

The main method, if not the only method, by which mosaic is spread, is by the use of either infected stocks or scions for vegetative propagation by budding or grafting.

It is important to note that once a tree becomes infected, there is no spray or similar treatment that will eliminate the disease.

In practice therefore, the problem of mosaic control must be attacked chiefly in the nursery. In propagation work, scion material must be taken from mosaic-free parent varieties, from trees which, over a number of years, have shown not even a trace of mosaic on **any** of their leaves.

Selected healthy parent trees should be plainly marked after inspections of the orchard during November and December.

Later in the summer, affected leaves may wither and symptoms may be more difficult to find.

And what of the rootstocks? With the exception of seedling rootstocks, these also must be taken from mosaic-free parents, otherwise the virus may pass up through the graft union into the scion.

These are simple precautions to take during propagation, and any departure from these simple rules, leaves the way open to the propagation of mosaic-infected apple trees.

(From a Country Hour broadcast. Reprinted by courtesy of the Australian Broadcasting Commission.)

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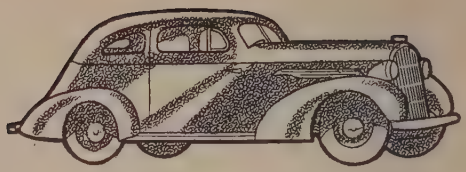

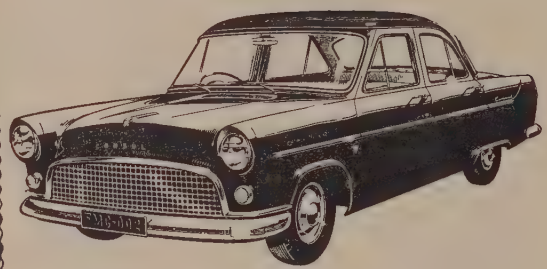

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BULK HANDLING IN THE ORCHARD

By J. C. ROWBOTHAM, Horticultural Instructor

BY using specially-designed tractor-drawn trailers to transport apples in bulk from the trees to the grading and sizing machines, Mr. Ralph Grist, of Donnybrook, has effected considerable saving in labour on his 16½-acre orchard during the harvesting period.

Some rough calculations showed that in the average season, he and his employees lifted and put down bushels of apples about 30,000 times by the time the fruit reached the graders.

As the usual method of fruit harvesting involved a heavy expenditure on picking-boxes, or alternatively the soiling of a number of export cases by dust or mud, in addition to the strenuous physical labour, Mr. Grist decided to experiment with bulk-handling.

He constructed a trailer capable of carrying 60 to 70 bushels of fruit and equipped to suit his particular conditions, and as this operated successfully he made two more.

Each trailer has an inside measurement of 10ft. 6in. long by 6ft. wide with sideboards 9in. high, and endboards 18in. high to enable the fruit to be stacked higher in the centre without rolling off when descending or ascending fairly steep slopes. The sideboards were kept low to obviate high lifting of filled picking bags. If a cranked or car-type axle is fitted, the top of the sideboards is only about 2ft. 9in. above ground level.

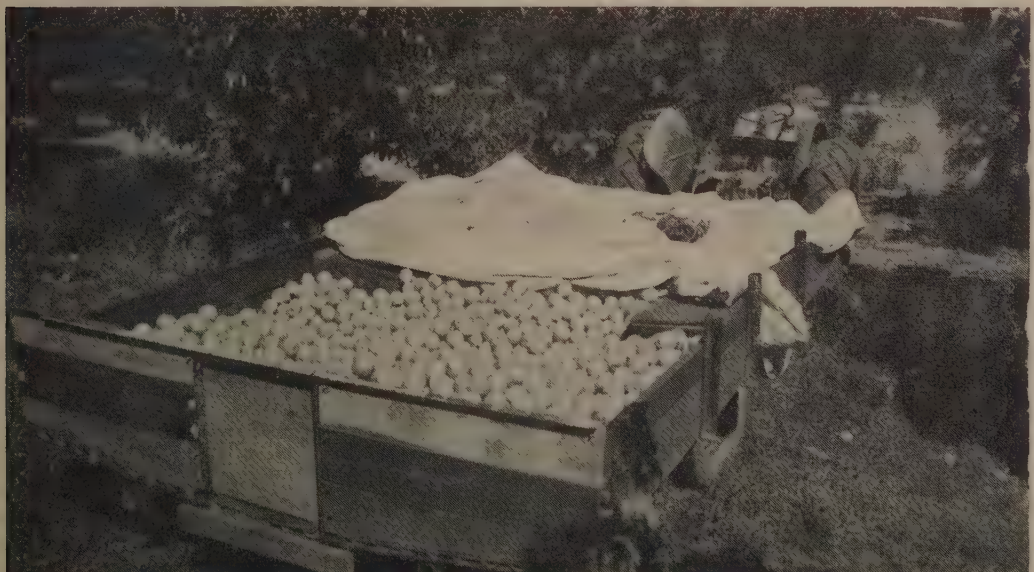

Fig. 1.—One of the bulk-handling trailers in the orchard. Note tent-fly used to protect the fruit from sun and dust

CONSTRUCTIONAL DETAILS

The floor of the trailer is made in the form of a broad V so that fruit rolls easily to the centre of the vehicle to facilitate emptying. The floor itself is made from 11ft. lengths of 6in. x 1in. dressed jarrah covered with linoleum. This material was found by experiment to give the best results as it enables the fruit to roll and slide freely, is easily swept free of twigs and dirt, and is weatherproof.

The two main 11ft. fore-and-aft bearers are of 5in. x 4in. jarrah. The four cross-bearers are 7ft. long and are made from 7in. x 3in. timber cut with a V that is 3½in. deep at the centre.

The centre pole or towing bar is an 11ft. length of 4in. x 4in. jarrah, projecting the required distance in front of the trailer and bolted to the cross-bearers.

A length of 1¼in. piping with a plate welded on the bottom end serves as an adjustable prop or leg on the drawbar. The piping is inserted in a 1½in. socket which is drilled and tapped to take a cranked and threaded length of round iron which serves as a set-screw to hold the prop at the required length.

A pair of car or truck wheels, with tyres, tubes and a suitable axle are fitted, and the wheels are boxed in. If the wheels and

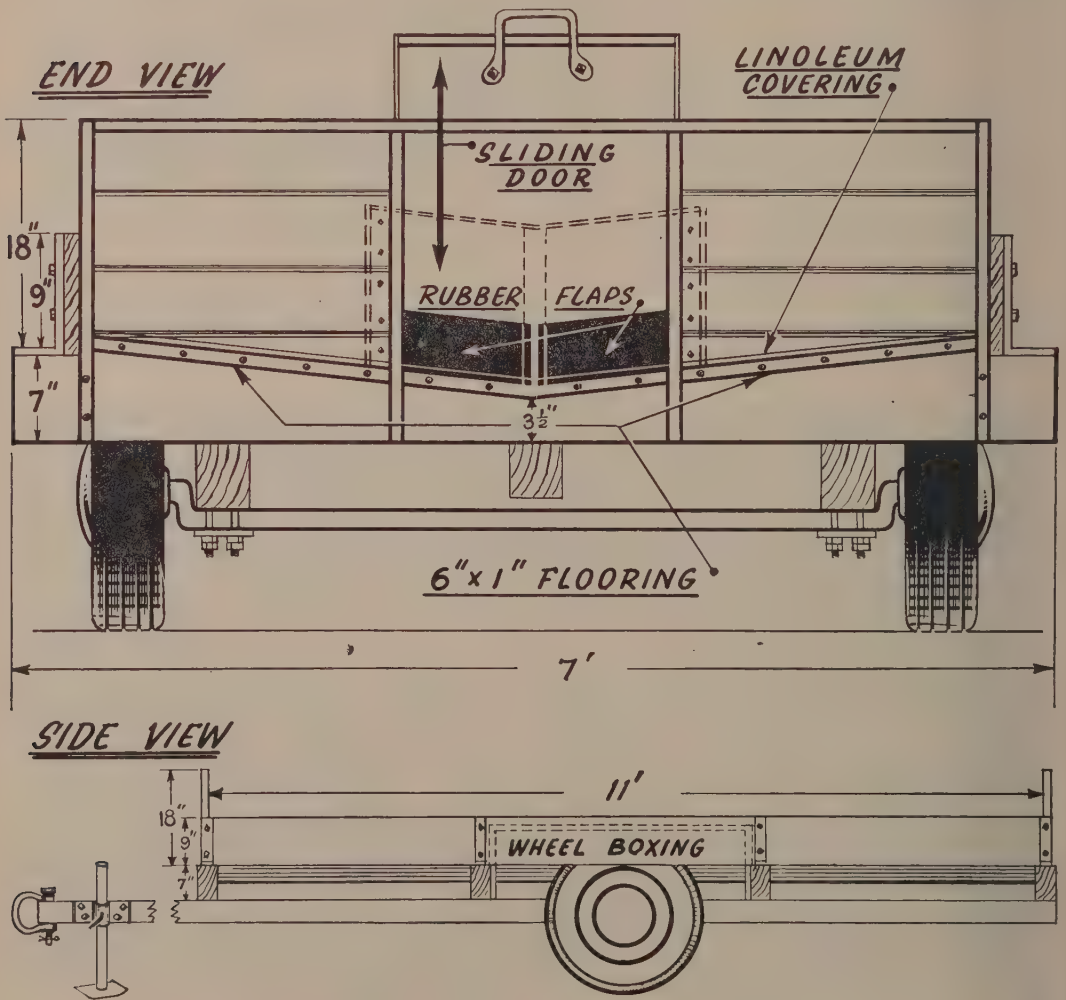

Fig. 2.—Diagrams showing the main constructional details

axles are made readily detachable, they could be used for other purposes if desired, and the trailer bodies could be stacked to take up less space during the winter months.

L-shaped stays of 2in. x ¼in. iron are bolted on to the ends of the cross-bearers to support the sideboards.

The tailboard carries a sliding door of a suitable width to allow the apples to flow into the elevator. Two heavy rubber flaps are screwed inside the tailboard so that they meet across the inside face of the door when closed. When the door is raised the weight of the apples curves the flaps round the edges of the opening where they prevent the fruit from being bruised by contact with sharp corners.

The loaded trailer is backed up so that the sliding door is opposite the elevator. It is then tilted and held in position by the adjustable prop on the towing bar, and the door is raised to allow the apples to roll on to the elevator rollers.

The three trailers which Mr. Grist has constructed permit one to be emptying at the packing shed, with one filled in reserve under cover and a third being filled in the orchard. The average cost of each (less labour) was about £25.

Mr. Grist's shed is ideal for this type of bulk-handling as it is on sloping ground with the intake end at ground level and the output end at truck floor height for easy loading.

To adapt his fruit grader to the trailer delivery, he removed the hopper from the bottom of the elevator which was then lowered almost to floor level so that the apples moved through the sliding door on to the rollers when the trailer was tilted.

For ease of handling, the trailer should be fairly evenly balanced on the axle so that one man can lift and hold the pole even when the trailer is filled to capacity.

Any tractor driver with experience in handling trailers can manoeuvre the outfit squarely up to the end of the elevator, but a refinement which Mr. Grist intends to introduce before next season is a pair of concrete wheel channels above floor level. Apart from acting as wheel guides, these will enable him to increase the angle of tilt and so permit better movement of fruit towards the door.

NO SIGNIFICANT BRUISING

It may be thought that bulk-handling may lead to bruising of fruit but such is not the case, provided that care is taken in loading the first few bags of fruit. This merely involves careful placing of the lower end of the picking-bag near the centre-line of the trailer and easing the apples out.

If this is done, there is much less chance of bruising the apples than there is when pickers shoot them straight into a picking box or try to squeeze a bulging bag into the box to lessen the distance the fruit has to fall.

A tent fly is used to protect the fruit from sun or rain while in the trailer, and the trailer is parked in the shade of the trees whenever possible.

LABOUR SAVING

Using the trailers, Mr. Grist has been able to save one man's wages besides reducing his own working day. Formerly, he had to take out a load of boxes early in the morning and place them at suitable points in the orchard. The filled cases had to be carted into the shed at intervals during the day and when the pickers had finished he had to spend some time carting in the last filled cases and stacking them near the hopper of the sizing machine.

The trailers have abolished much of the lifting and carrying of fruit-filled cases and increased the speed of handling.

ADAPTATION

Obviously, not all fruitgrowers can use this method in its entirety. Many shed floors are built-up to truck level, but even here, the addition of sloping ramps might be worth considering.

Using smaller bulk containers with strong hooks or eyes at each corner, an overhead lifting gear and "traveller" could assist in taking the fruit to the elevator. Alternatively, the hydraulic gear fitted to many modern tractors could be used for lifting and carrying bulk containers. In the larger packing houses bulk containers could be handled by fork-lift trucks.

Bulk handling makes possible a reduction in handling costs which could bring great benefits to the industry.

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Fashionable Dressing is Easy for the Home Dressmaker

By MARGARET SPENCER

IT was a long step from the first primitive "dressmaker's guide" to today's scientifically designed and cut paper dress-pattern. In the 13th century when a French tailor made patterns from thin wood his invention was successfully resisted by the Tailors Guild for more than one hundred years.

It was the Germans who gave us the first paper patterns, but with ten patterns on one sheet, all cut to size 36in., the dressmaker had to be good! Then in America in the 1860's a new development was made when Ebenezer Butterick cut graded sizes in one pattern which were very much easier to follow. His first patterns were for men's clothing but the idea was so popular that he was soon making dress patterns.

A fabulous industry came into being, and there have been steady improvements, to give us today's dress patterns which are planned, measured, marked and cut with meticulous accuracy. With the skill and experience of many years behind them, the fashion designers and patternmakers place economical smartness within every woman's grasp—but whether she achieves it is up to the home dressmaker herself.

Select your pattern wisely. First "know yourself." Study your figure and your type and decide what sort of clothes are best for you before making your choice from the wide range of fashionable styles. Don't be a "fashion-slave"! There may be many styles, all up-to-date but all may not be meant for you. Never forget to think about the occasion for which the garment will be required—it is so important to your enjoyment of it to be suitabley dressed. A wise maxim to remember is "It is better to be under-dressed than overdressed," so avoid exaggeration of style and detail when choosing garments.

Finally remember that perfect fitting is essential to the success of all clothing, so take care to check your measurements against those on the envelope. As the

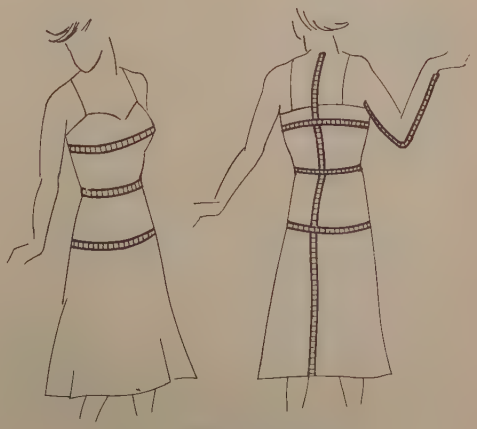

Fig. 1.—Taking measurements

numbering of sizes on some patterns has been changed quite recently, this is especially important.

In measuring, take the bust measurement around the largest part, with the tape slightly higher in the back, and don't tighten the tape. The waist measurement is taken quite firmly around the natural waistline, while the hips are measured about 7in. below this, the tape measure being held level. These measurements are the ones you need in choosing your pattern and are taken over your normal

Fig. 2.—Square shoulders—add required height at shoulders and again at armholes so that sleeve will fit. Do not alter neckline

underclothing. Allowance for fullness in blouses, coats, etc., is made by the pattern-maker. Dress patterns are bought to correspond as closely as possible with the bust measurement, while skirts and slacks require waist and hip measurements.

Length measurements do not affect the pattern chosen, but do affect the quantity of material required, so take these too, measuring from the socket-bone at the back of the neck to the natural waist line and hemline, and from the armpit to wrist for sleeve length.

Generally it is best to buy your pattern first so that you can buy the recommended quantity of material. Among the points to watch are that you buy material suitable for the style. The pattern designer usually gives you recommendations as a guide. After all you are only heading for disappointment if you choose a pattern cut with folds or drapes, and then buy material which does neither, gracefully.

Also if buying material with a "pile," or with fibres having the appearance of all going the one way, or one-way prints, buy the quantity of material specified for the garment "with nap." With velvet of all kinds so attractive and fashionable this year, remember that it comes in this category and all pieces **must** be cut with the pile running the same way, smoothing upwards.

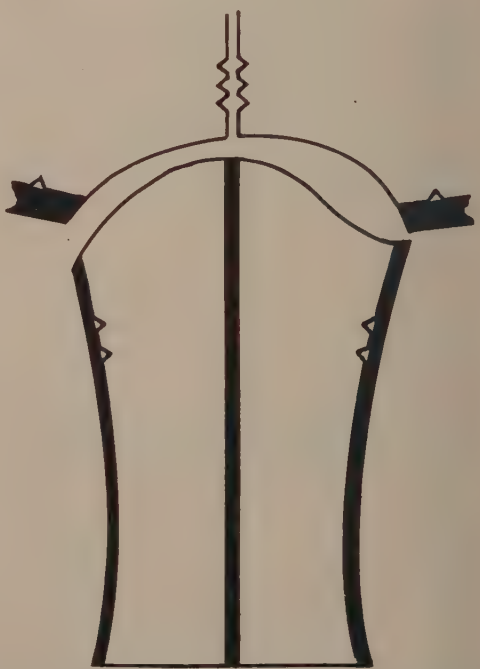

Fig. 3.—Large arm—cut and separate pattern. Put in insert of paper; add at seams and enlarge armholes to fit.

Fig. 4.—Big hips—add width at side seams, tapering in at the waistline and out at hemline

ALTERING PATTERNS

Before cutting out, the pattern pieces should be fitted and alterations made where necessary. Have plenty of large sheets of tissue paper ready and if much adjustment is required trace out the pattern on the paper and alter as needed, keeping the original intact for checking armhole shaping, neckline, etc. Remember that if sleeve width is altered, the armholes must be adjusted and facings and collars must be altered to correspond with neckline changes. Alterations for some commonly encountered "problems" are shown in the accompanying diagrams.

Having made the alterations for that "special" garment you have in mind, you may be wise to make up a cheap muslin model. It will not take long, but may save you a lot of money and heartache. Besides, you will have learnt a lot for future guidance, and next time you buy a pattern from the same makers you will know just how it must be altered for your particular figure.

Many of today's fabrics are shrunk when purchased but, if your material is not one of these, shrink it according to its type. Cotton and linen should be left folded and soaked for several hours in cold water. Hang over a clothes-line till almost dry then iron carefully the way of the thread, to avoid stretching. Woollen fabrics are handled differently being placed on a wet sheet and then rolled up smoothly with it. After being left overnight they are pressed on the wrong side, over a pressing cloth with a "press and lift" movement. The end of the material should be straightened and to do this pull a thread. If the material has been stretched out of shape in the final manufacturing processes pull it gently "on the cross" that is diagonally. With your material and your pattern ready, find a large clean flat surface for cutting out your garment. If no large table is offering the floor is a good spot—if you are young enough and agile enough not to mind a little extra exercise!

Read your instructions carefully and look for the markings showing the way the grain should run, and where pieces must be placed on the fold, then with your cutting guide in front of you go ahead placing your pattern. Use fine, sharp pins unless these mark the fabric, in which case the weights from the kitchen scales, or any other small solid objects—or even durex tape—may be used. When cutting, a really sharp pair of shears with at least 6in. blades is needed, and open them wide with a regular movement to give a smooth edge. Keep the material as flat as possible to avoid pulling it away from under the pattern and cut all notches as **outward** projections so that you do not cut into the seam allowance. Remember, all markings on the pattern are important so, before the pieces are removed, mark the perforations with tailor's tacks or chalk, using different colours for the different sized holes.

It is invariably found that the actual sewing is much easier and the finished garment has a much more "professional" appearance if care is exercised in the preparation of the pattern and the material, and in the cutting and marking of it. There will be no time-wasting juggling of pieces to make them fit and no unpicking of seams. It is worth the little extra time and trouble at the start and will ensure that your new outfit really looks like the design on the envelope—the one you chose with such enthusiasm.

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MEXICAN CURRANT MEAT PATTIES

1 lb. minced steak
1 teaspoon minced onion
1 tablespoon tomato puree or sauce
1 lb. potatoes
½ cup shredded pineapple
¾ cup S.R. flour
Nut of butter
1 egg
1 tablespoon chopped parsley
Seasoning to taste
2 tablespoons currants

Mix meat, onion, pineapple, currants and puree. Season and cook 10 minutes. Mix mashed potatoes with butter, flour, egg (beaten) and parsley. Turn on to floured board. Roll to ½ inch thickness, cut into 3½ inch circles. Place some meat mixture on each circle, wet edges and fold over. Decorate edges with a fork. Place on greased slide. Bake in hot oven 400 degrees, 15 minutes, and serve very hot.

VITAMIN A

SUPPLEMENTS FOR SHEEP AND CATTLE

By L. C. SNOOK, D.Sc., Animal Nutrition Officer

VITAMIN A is essential for the health and wellbeing of all animals and birds. This vitamin is obtained by grazing animals from carotene, an orange pigment present in green plants. When plant material matures and dies, the carotene is quickly destroyed by sunlight. This means that dry herbage in the field becomes worthless as a source of Vitamin A.

Farmers appreciate these facts, hence it is natural that during the long dry summer concern should be felt for the welfare of stock on dry feed. If by any chance ewes fail to conceive, weaners cease to thrive, or heifers fail to come into oestrus, then the possibility of vitamin A deficiency immediately comes to mind. In many cases, rather than run any risk, farmers buy commercial vitamin A preparations. This may be a commendable precaution but the supplements are costly and when stock have to be yarded and drenched, the extra work is considerable. It is worthwhile, therefore, to give careful consideration to the likelihood that grazing animals in the farming areas of Western Australia already obtain plenty of vitamin A from the foodstuffs normally available.

VERY LITTLE IS NEEDED

It is surprising how little greenstuff is needed to supply the needs of an animal. One pound of fresh green grass each day contains enough carotene to provide all the needs of at least 50 sheep or five milking cows. In other words, so long as animals obtain a mere nibble of greenstuff there will be no lack of vitamin A. This "nibble" of greenstuff is available over a far longer period than many farmers realise. On most properties there are areas of rough country carrying perennial shrubs, "suckers," and trees which keep green throughout the summer. The foliage may be unpalatable but an occasional leaf will go close to satisfying the animals needs for carotene. The various acacia shrubs, for example, may be harsh and thorny but towards the end of summer most of these will have been thoroughly pruned by grazing animals.

In many favoured areas, native and introduced pasture plants survive well into the summer. These may not give an appreciable bulk of feed but will certainly eliminate all need for the purchase of vitamin A supplements. The shrubs which persist in salt-lake country along with the top feed of pastoral areas provide similar service as reservoirs of carotene.

VITAMIN A MAY BE STORED

Even on the unusual farm where everything green has been killed or eaten out, it is unlikely that vitamin A supplements will be needed. Grazing animals protect themselves against hard times by storing considerable quantities of vitamin A in their livers. After a month or so on abundant green winter pasture adult sheep and

cattle should have enough vitamin A in reserve to last for at least six months, even on a diet completely devoid of carotene. Peirce (1954) found that ewes had to be kept in pens on deficient rations for 16 months before the blood concentrations of vitamin A became significantly depressed. It seems that breeding ewes on a deficient diet have to be carried into their second pregnancy before the health or vigor of the lamb is affected.

It is unlikely, however, that grazing animals will be entirely dependent on liver reserves during the summer months. Good quality cereal hay, for example, can supply **all** the needs of sheep and cattle of all ages. Silage is a rich source of carotene and if made available to stock in the late summer months would eliminate any fear of vitamin A deficiency.

Cereal grains in general are poor sources of carotene. Even so, in Western Australia it is unlikely that stock will be fed on grain alone for periods sufficiently lengthy to produce vitamin A deficiency. In a drought feeding trial (Sims and Webb, 1946) carried out in the Victorian mallee, Merino ewes were kept in a small bare paddock for eight months. They were kept alive on wheat-grain fed twice weekly at the rate of 0.9 lb. per head daily. On this meagre ration the ewes were mated and **reared** 51 per cent. lambs. Such losses as did occur could be attributed to lack of food rather than to lack of vitamins. The willingness of ewes to mate and the ability to conceive is not reduced even in extreme vitamin A deficiency.

To produce healthy lambs, however, about two to three milligrams of carotene or vitamin A is required by the ewe each day. This must be obtained from the food or from the liver reserves. Foods in common use have been found to contain the following amounts of carotene—

Fodder.	Milligrames of Carotene Per Pound of Food.
Fresh green clover(1)	200-350
Fresh green grass(1)	170-290
Clover silage(2)	60-80
Oaten silage(2)	6-36
Clover hay(2)	1-16
Cereal hay(2)	Negligible -6
Cereal grains(2)	Negligible -0.6

(1) Peirce (1946).

(2) Underwood and Curnow (1944).

The data in this table indicate that the provident farmer should be able to conserve fodder sufficiently rich in carotene to eliminate all fear of vitamin A deficiency in sheep and cattle.

LOCAL EXPERIMENTS

The above evidence may seem somewhat theoretical, and the practical man may be more convinced by the results obtained in an experiment carried out at the Wongan Hills Research Station in 1954. The summer of 1953-54 was a dry one, no green feed being available in the paddock from early November until the end of May. On February 18, 1954, 200 mated ewes were run through a race and ear tagged. Each alternate ewe received half-a-million international units of Vitamin A per medium of a drenching gun. The ewes received dry paddock grazing plus oat grain at the rate of 1 lb. per head daily (fed three times per week.)

The two groups were separated prior to lambing. Details concerning the trial have been summarised in Table I.

TABLE 1.—LAMBS BORN AND TAILED 1954.

	Control Groups (100 ewes)	Groups Receiving Vitamin A. (100 ewes)
Number of lambs identified and weighed	71	61
Average weight at birth (lb.)	8.7	8.1
Unidentified lambs found dead	7	4
Number of lambs tailed	62	56
Average weight at tailing (lb.)	22.6	21.4

It was unfortunate that there were so many non-pregnant ewes in the line selected for the trial. The results do not suggest, however, that the vitamin A supplement was of any value in increasing the birth weight or viability of the lambs, or in stimulating growth rates.

WEANERS

Unthriftiness in weaners is a serious problem in parts of Western Australia. Lack of vitamin A has been listed as one of the likely causes of this unthriftiness. Significantly, however, the problem appears to be most serious in the lower Great Southern areas where, for reasons already discussed, one would least expect a prolonged lack of carotene in the diet. The unthriftiness of the weaner is much more

likely to be due to poor milk production by the ewe and/or to poor quality paddock feed.

It should be remembered that colostrum is rich in vitamin A and if the ewe is in good fettle the lamb should be able to build up useful liver reserves, even if born late in spring. These lambs may have to be weaned onto dry feed but the requirements of the weaner are no greater than those of the pregnant ewe. Young animals should obtain adequate supplies of carotene from the conserved fodders normally available. If weaners do benefit from vitamin A supplements this suggests faulty animal husbandry rather than that weaners in general require additional vitamin A. Of course, under drought conditions where weaners have to subsist for months on bleached roughage with or without cereal grain, the use of supplements rich in carotene or vitamin A could reduce losses.

Even under these extreme conditions, however, the provision of extra food could be of more importance than extra vitamins. Good quality hay with a tinge of greenness will supply both the food and the carotene.

In 1954 at the Wongan Hills Research Station an experiment was carried out with 50 crossbred weaner wethers. On February 22 the animals were weighed and each alternate one was given 500,000 international units of vitamin A. The sheep were then placed in a paddock containing dry subterranean clover and dry annual grasses. Oat grain was supplied at a rate of 1 lb. per head daily. The changes in body weight are recorded in Table II.

TABLE II.—BODY WEIGHT CHANGES IN WEANERS.

Average of 25 wethers (lb.)

Date Weighed.	Control Group.	Vitamin A Group.
22/2/54	81.9	82.5
29/4/54	82.2	84.2
31/5/54	87.6	89.3
Gain for whole period	5.7	7.3
Gain over last month	5.4	5.6

All the animals remained in apparent good health and condition, although there was no green feed for almost seven months. The leaves were stripped from a few *Casuarina* shrubs in the paddock and these could have nullified the effect of the vitamin A supplement. The overall changes in bodyweight do appear to favour the supplemented group but the difference would be of little significance in practice. During the final month on dry feed, when one would have expected the deficiency of vitamin A to exert its maximum effect, both groups showed a similar increase in body weight.

RAMS

In pastoral areas where low lambing percentages have become a serious problem, the suggestion is often made that lack of greenfeed may be reducing the fertility of the rams. Here again it can be stressed that the semen quality of rams is not likely to be affected until the rams have been kept for four months or more on rations practically devoid of carotene or vitamin A. If the animal can get an occasional mouthful of green "top-feed" or a few green shoots from spinifex tufts, this should suffice to maintain the vitamin A reserves at an adequate level. Lack of vitamin A will cause nightblindness in a ram before it will affect the quality of the semen. It should be a simple matter to find out if the rams are "night blind." On a moonlight night, or at dusk, drive the rams through an area containing logs or stumps or boxes. If the rams avoid these obstacles quite easily in dim light, it is most unlikely that lack of vitamin A has affected fertility. Perhaps this statement should be qualified to the extent that if the potency of a ram has been reduced by lack of vitamin A it may take two months on a diet rich in carotene to restore the semen quality to normal. In other words, the night blindness could be corrected before fertility was restored in a ram which had been kept on dry—really dry—feed for more than six months.

SUMMARY

Where grazing animals have access to green feed over the winter months it is unlikely that vitamin A supplements will be required during a normal dry summer in the agricultural areas of Western Australia. After a month on green feed the vitamin A conserved in the liver is sufficient to supply the total needs of grazing animals for many months.

On most farms the foodstuffs normally available to grazing animals supply some

carotene, even during the summer months. Only under extreme conditions will stock have to depend entirely on liver reserves.

Silage can be a rich source of carotene. Hay which is cut and conserved so as to retain a green tinge will supply adequate carotene to sheep and cattle of all ages.

Unthriftiness in grazing animals during the summer months is more likely to be due to lack of good food in general, rather than to lack of vitamin A in particular.

Under the conditions which apply in the Western Australian agricultural areas it is unlikely that the breeding efficiency of rams or ewes will be reduced by lack of vitamin A.

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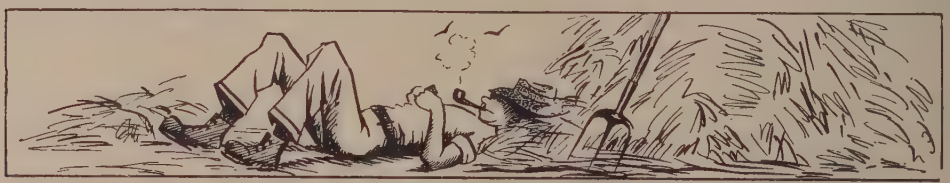
ACKNOWLEDGMENT

The experimental work to determine the value of vitamin A supplements at the Wongan Hills Research Station was carried out under the direction of Mr. A. F. Smith, Agricultural Adviser, who at the time was Acting Manager at the Research Station.



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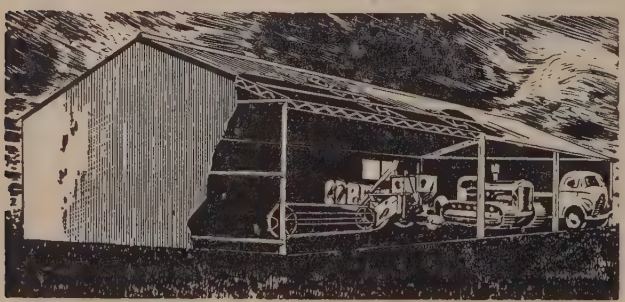

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Note the poor germination from freshly-cut setts (right foreground) compared with the even growth of the suberised setts

SUBERISATION OF CUT POTATO SETTS

By Officers of the Vegetable Section

WHEN freshly-cut potato setts are planted out, the cut surface often comes into contact with soil-borne organisms, some of which tend to induce rotting of the setts, and a consequent poor germination. These rotting organisms are especially numerous in ground which is used for growing potatoes year after year.

It is possible, by certain established practices, to induce the development of a protective layer of cork cells over the exposed cut surface, which will form an effective barrier against decay organisms. The healing of the cut surface is called callousing or suberisation—the name being derived from the exudate of the cut potato surface called suberin. This chemical under moist conditions makes a continuous layer over the surface, which on drying forms a protective cover.

Under favourable conditions of temperature and moisture, this process of callousing can take place in the soil after planting. However, in many cases, soil conditions at the time of planting, particularly during summer are conducive to the build up of decay organisms and rotting may take place before callousing can be effected. The recommended method for inducing suberisation is to place the freshly cut setts into wet bags for 24 to 48 hours.

The importance of this protective layer on the cut surfaces of potato setts has been demonstrated in a trial carried out by Mr. G. P. Ayres, a potato grower at Bornholm.

Comparison was made between a plot of potatoes planted with freshly cut setts, and another plot planted with setts that were kept under wet bags for four days prior to planting.

The latter treatment resulted in 94 per cent. of the setts germinating, and pro-

ducing an even, strong and vigorous stand, whereas freshly cut and planted setts gave an uneven stand with 43 per cent. of the plants missing. The difference can be clearly seen in the accompanying photograph.

Examination disclosed that the "misses" were due to rotting of the setts.

Although not tested in the trial, from experimental work carried out, it could safely be assumed that the use of zinc oxide would have further improved this better germination. Zinc oxide has fungicidal properties and its use in conjunction with the wet bag treatment is recommended by the Department of Agriculture. The chemical is used as an instantaneous dip and the solution is prepared by adding zinc oxide to water at the rate of 5 oz. to the gallon.

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Do you know that the Department of Agriculture provides a comprehensive service of advice and technical assistance to farmers, free of charge?

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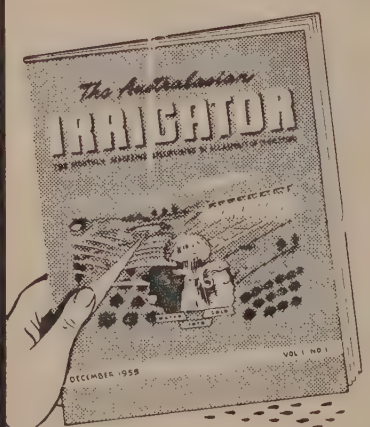

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RABBITS *are* SCARCE . . .

MAKE THEM SCARCER STILL !

By C. MARSHALL, Senior Vermin Control Officer

NEVER before in the history of rabbits in Western Australia has control work been so important as it is today. Strangely enough, it is not large numbers of rabbits which make stricter control necessary, but the relatively low numbers now present. Following the introduction by the Agriculture Protection Board of the disease myxomatosis, and later the new poison "1080", the rabbit population in this State has been reduced to a point where farmers are inclined to take their old enemy too cheaply. Because they do not see the rabbits around in the numbers of previous years, they are inclined to neglect control work, or to dismiss it as unimportant.

This could be the greatest mistake they have ever made, and may be the opportunity rabbits require to re-establish themselves.

RESIDUAL RABBITS VERY SHY

Field officers of the Vermin Control Branch have observed that rabbits to-day are truly wild and very seldom seen during the light of day. They prefer to feed under cover of darkness. This of course leads some farmers to underestimate the true position, and in fact to live in a fool's paradise. I am sure that if the position is inspected carefully, it will be found that some rabbits have survived in all areas previously infested, and that they only wait for farmers to relax their efforts before they stage their come-back.

RECENT DEVELOPMENTS

Some very important and interesting developments have been noted from our field and investigational work over the years. We have found that rabbits can be controlled by the use of poison bait—two drives a year being most effective if properly carried out. I say "controlled" not "exterminated." If the latter result is required, it will be necessary to destroy all warrens and other cover. This is in addition to the use of poison bait. If properly applied, poison bait will be successful during the summer, winter and spring months, regardless of the type and quantity of the natural feed available.

OATS AND APPLES WITH "1080"

Plain oats or fruit are both suitable for free feeding and baiting if used with "1080" poison. It must always be remembered that free feeding is the essential part of a successful poison drive; without it, high percentage kills cannot be expected.

IMPORTANCE OF PROPER TRAILS

The placement of the trails and the care taken in making them also have a major bearing on the final results. All trails must be taken to the rabbit—this is important. We have proved that rabbits will not change their habits appreciably to visit trails which are outside the area they have been feeding over. It is possible to miss some rabbits entirely by having the trial just a few yards in the wrong direction. This trail placement is specially important when bush and other cover are present. We have proved conclusively that rabbits from areas with no natural feed can be controlled by the use of poison

Laying "1080" poisoned baits on a property in the Balingup district

bait; it is purely a matter of placing the bait to the best advantage. All farmers should study the habits of the rabbits on their properties before cutting the trails. They will be amply rewarded for the time spent.

COMPLETE ERADICATION

Complete eradication, without the destruction of warrens and other cover is not practicable but this should be the final aim of any control programme undertaken by the landholders. We know that it may not be convenient for farmers to undertake this type of work and complete it in one season, but we do recommend that some plan should be adopted to provide for the progressive destruction of all harbourage, even if the plan is spread over a number of years. A two-fold benefit will result from this work—the reduction of the fox and rabbit pests, and improved pasture for stock.

ORGANISED DESTRUCTION DRIVES

Another important lesson we have learnt during our investigations is the value of organised drives. These drives must be arranged to cover large areas simultaneously, and every farmer should participate if the maximum benefit is to be obtained. The success of this work will depend on the complete co-operation of farmers, vermin boards and this Department. I consider this can best be obtained through our Group Vermin Inspectorial schemes. These schemes enable the A.P.B. to make full use of the organisation and information at its disposal, and to use its plant and equipment to the best advantage.

SOME GENERAL OBSERVATIONS

There are several important factors in rabbit control which require careful thought. We have now reached the stage when it is quite safe to claim that rabbits are controlled (but not eradicated). They have been reduced to such a low level that the average farmer very seldom sees one on his property. This creates a false sense of security in the mind of the landholder, and often leads to neglect. What must be remembered is this— (1) Due to the large

reduction in numbers, the feed near their natural cover is now plentiful and therefore the rabbits have no reason to travel far from that cover (2) Due again to reduced populations resulting from the intense destruction campaigns against them over the past three years, the rabbits have become very timid and seldom leave the cover during the day. (3) Although rabbit numbers are few, they are scattered over a large area, and to get this few, farmers must be prepared to lay the same amount of poison trail as they would have laid when they poisoned for large numbers. Reduce the amount of free feed and poison bait by all means, but do not reduce the length of the trail.

The same principle applies to warrens. Although they may appear to be dead, destroy them. They may have a few rabbits sheltering in them.

The cost of destroying the odd rabbit to-day may be as high as £1 per head. But this expenditure now could be the means of saving hundreds in future years.

UP-TO-DATE HINTS ON RABBIT CONTROL WORK

The following few points are well worth remembering when planning rabbit control programmes.

Do not depend on or wait for the myxomatosis virus to produce a miracle on your property. Do not rely entirely on one type of control; use all methods available. Do not operate as an individual; insist on the introduction of the drive system in your district. See that all holdings are included in such drives. Before commencing your drive, make sure that you know where the rabbits harbour and lay your trails accordingly. Do not stint the length of your trail. Do not miss any areas because you consider the few rabbits unimportant; they will soon prove you wrong. Free feed prior to laying poison bait. This is a **MUST** if you wish for the best results, and only the best will suffice in rabbit control. Feed according to the requirements of the rabbits visiting the trails, and continue feeding for three or four days. Do not poison until the trails are clear of the free feed. Do not be mean when laying poison bait—16 lb. to the mile of trail for the average rabbit infestation; you can estimate the amount required from the free feed taken.

Destroy all cover. Warrens, logs and other harbourage remain an open invitation for travelling rabbits to take up residence. They also protect rabbits from their natural enemies.

The main materials used in the preparation of rabbit bait are now oats and apples. When used with "1080" poison in the A.P.B. scheme, no preparation is required with either bait, apart from the cutting of the apples. When using strychnine with oats, the oats must be sweetened by the addition of molasses.

One rule which must always be remembered is that of cleanliness. Be sure that you use nothing but the best materials. Water and utensils must be clean and fresh; rabbits will not take bait that is dirty, stale, or contaminated in any way.

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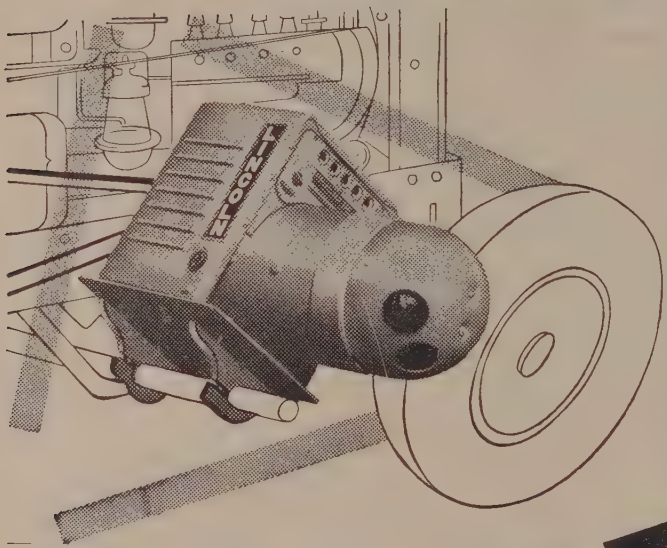

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WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE

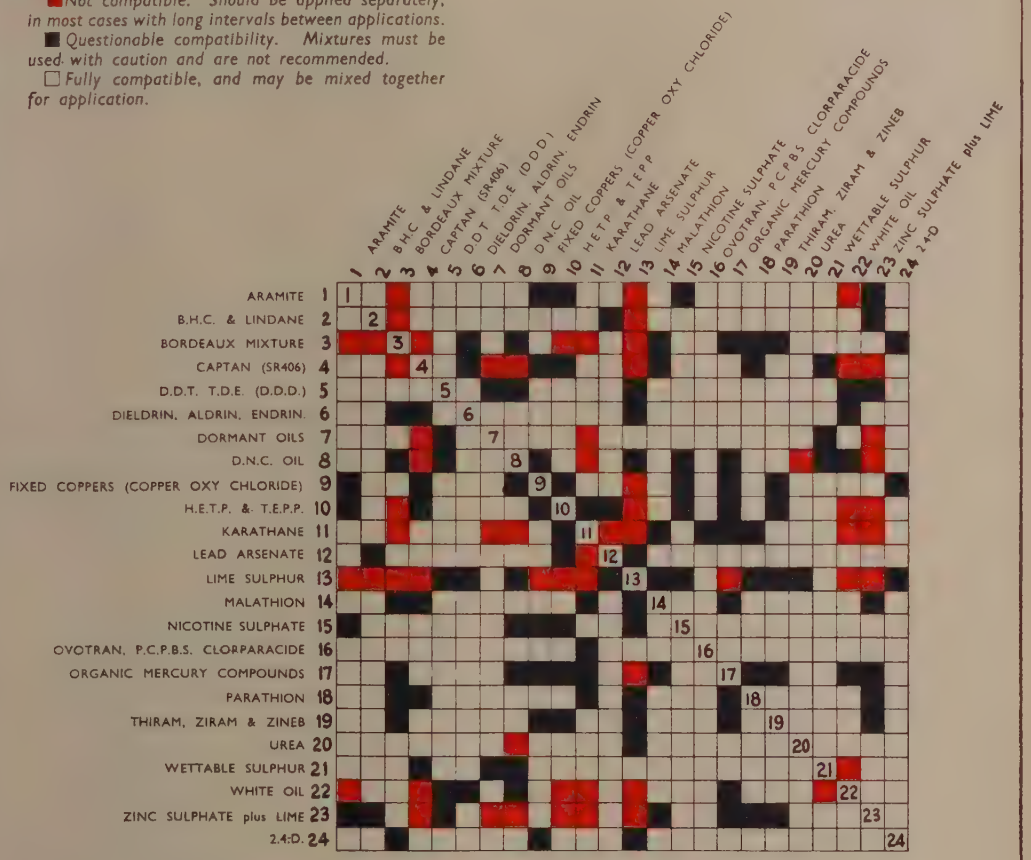
COMPATIBILITY CHART

KEY —

■ *Not compatible. Should be applied separately, in most cases with long intervals between applications.*

■ *Questionable compatibility. Mixtures must be used with caution and are not recommended.*

□ *Fully compatible, and may be mixed together for application.*



NOTE — *If the need arises to use materials not included in this chart, growers are advised to contact the Department of Agriculture.*

The chart applies only to two-material spray combinations. Where three or more materials are mixed together, further incompatibilities may occur.

If the recommended concentrations are exceeded, further incompatibilities may occur.

Incompatibility may be due to—

(1) *Reduced effectiveness of one or both materials.*

(2) *Plant damage resulting from the combinations of two materials which would not occur if either material was used separately.*

(3) *Curds or precipitate resulting from the combination of two materials causing nozzles to be clogged or a failure of the spray to deposit properly.*

A Spraying Guide for the Control of Pests and Diseases of Fruit

THE following guide for the spraying of fruit trees has been prepared as a ready reference for fruit growers and as a seasonal reminder of control measures necessary to deal with orchard pests and diseases. The charts have been kept as brief as possible, consistent with supplying details of recommended materials, concentrations and time of application, and growers should consult Departmental leaflets or Departmental officers for more detailed information.

The choice of the right materials and application at the optimum time are all important, but the use of efficient spray equipment and the effective application by operators conversant with the problem in hand are also essential for successful control.

Growers are advised to follow a carefully-prepared spray schedule designed to deal with pests and diseases likely to be encountered, rather than wait until heavy infections occur when it is often too late to apply effective control measures.

COMBINATIONS OF SPRAY MATERIALS

Certain combinations of insecticides and fungicides can be successfully applied in a single spray. This is useful where more than one pest has to be dealt with at one time. However, some mixtures should not be used as they may cause damage to the trees or the effectiveness of one or both of the materials may be reduced or even destroyed. Before combining any two spray materials, reference should be made to the **Compatibility Chart** included in this publication. The combinations on the chart marked in red show that the materials are incompatible and should not be mixed. Those marked in black may be compatible under certain conditions but are not recommended for general use. Those shown in white may be safely used. This chart only applies to combinations of two materials used at normal concentrations. Mixing more than two materials, or exceeding the normal concentrations may produce further incompatibilities. Growers requiring information on the compatibility of materials not mentioned on this chart are advised to contact the Department of Agriculture.

DILUTION OF CONCENTRATES

In many instances it is possible to express the concentration of the spray as the number of lb., gallons, etc., required to make 100 gallons of spray mixture. However, where the percentage of the active ingredient in the concentrate material varies with various manufacturers, this is not possible. To enable growers to work out the amount of concentrate required per 100 gallons, of the recommended spray, a Spray Dilution Table has been included at the end of this leaflet. The concentration of the proprietary line is given in the first vertical column and the required concentration of the final spray mixtures is shown along the top. The method of using the table is as follows:—

> Supposing the material to be used is a 25 per cent. concentrate and the spray required is 0.1 per cent., then by following across the table from 25 per cent. until the column headed 0.1 per cent. is reached, it is found that $3\frac{1}{4}$ pints of 25 per cent. concentrate are required to make up 100 gallons of 0.1 per cent. spray. A similar procedure is adopted for other concentrates and final dilutions.

SIMPLE STANDARD NAMES

Many of the newer insecticides and fungicides are so complex in composition that simple standard names have been

adopted throughout the world, to represent their chemical constituents. For example ziram is the simple standard name for zinc dimethyl dithiocarbamate and all proprietary fungicides containing this compound are referred to as ziram-type fungicides.

These simple standard names, which have been used throughout the charts, are displayed on trade labels in conjunction with the chemical constituents so that by reference to the label, growers can ensure that any particular proprietary line of insecticide or fungicide is of the required type.

PRECAUTIONS IN HANDLING SPRAY MATERIALS

Many pesticides introduced in recent years are toxic to humans, some much more so than others and growers should comply strictly with any safety precautions recommended by the manufacturers.

Instances of highly dangerous materials are—Parathion, HETP and Dieldrin and these should be handled with special care. Protective clothing should be worn and steps taken to see that the concentrate does not come into contact with any part of the body. Operators should not inhale the spray mist or allow their clothing to become saturated with the spray. Signs of headaches, giddiness or nausea should be dealt with promptly and medical aid sought.

DNC, DDT, BHC, Nicotine Sulphate, Arsenate of Lead and Phenyl mercury compounds are others which must be handled carefully.

Some of the newer organic fungicides may also cause skin irritation if handled carelessly and for this reason contact, especially with the concentrated materials, should be avoided.

FORWARDING SPECIMENS

Correct diagnosis of the trouble is essential for satisfactory control. Where the identity of an insect pest or disease is in doubt, a local Departmental Field Officer should be consulted or specimens forwarded to the Department of Agriculture, Perth. If specimens are forwarded, it is important that they be packed correctly so that they arrive in good condition. In the case of insects, wrap carefully in tissue paper and pack firmly in a cardboard box. They should not be forwarded in an airtight container.

Specimens for disease diagnosis should be forwarded as soon as possible after collection. Leaves should be pressed between sheets of cardboard or blotting paper; fruits or twigs should be wrapped in newspaper and packed in a suitable container to prevent damage in transit. If whole plants are submitted, soil should be washed from the roots before packing.

SPRAY DILUTION TABLE.

The following table gives the quantity of Concentrate to be mixed with 100 gallons of water to produce the required dilution.

Concentration of Proprietary Insecticide.	Concentration Required for Spraying.							
	2%	1%	0·5%	0·2%	0·1%	0·05%	0·02%	0·01%
10%	25 gal.	11 gal.	5 gal.	2 gal.	1 gal.	4 pts.	32 oz.	16 oz.
15%	15 gal.	7 gal.	3½ gal.	1½ gal.	5 pts.	2¾ pts.	20 oz.	11 oz.
20%	11 gal.	5 gal.	2½ gal.	1 gal.	4 pts.	2 pts.	16 oz.	8 oz.
25%	9 gal.	4 gal.	2 gal.	6½ pts.	3¼ pts.	1½ pts.	13 oz.	6 oz.
30%	7 gal.	3½ gal.	1¾ gal.	5 pts.	2¾ pts.	1¼ pts.	11 oz.	5 oz.
40%	5 gal.	2½ gal.	1¼ gal.	4 pts.	2 pts.	1 pt.	8 oz.	4 oz.
50%	4 gal.	2 gal.	1 gal.	3¼ pts.	1½ pts.	¾ pt.	6 oz.	3 oz.
80%	2½ gal.	1¼ gal.	5 pts.	2 pts.	1 pt.	½ pt.	4 oz.	2 oz.

Note.—1 gallon = 8 pints; 1 pint = 20 oz.

FRUIT TREE SPRAY CHART

APPLES

Pest or Disease.	Spray Material.	Concentration.	Time of Application.	Remarks.
		Winter.		
Bryobia Mite, Red Spider, San Jose Scale and other Scales	Dormant Oil	5 gals. in 100 gals. water	July to early August	
	or Superior Oil	3 gals. in 100 gals. water	August to early September	May be used nearer budburst.
	or D.N.C. Winter Oil	5 gals. in 100 gals. water	Late July to early August	Use in areas subject to delayed foliation.
	or Commercial Lime Sulphur	14 gals. in 100 gals. water	August to early September	Apply late in dormant period—when buds begin to swell. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
Powdery Mildew	....	....	....	In early winter prune out and burn all shoots showing mildew infection.
		Spring and Early Summer.		
Powdery Mildew . .	Lime Sulphur followed by	7 gals. in 100 gals. water (1 in 14 approx.). Add Calcium Caseinate (1 lb. in 100 gals.) as a spreader	Budburst	Check over the trees between green and pink bud stages. Remove all shoot and blossom clusters affected with mildew.
	Colloidal or Wettable Sulphur or	4–5 lb. in 100 gals.	From petal fall onwards at 10–14 day intervals	
	Karathane	1 lb. in 100 gals. plus 3 ozs. of a liquid spreader such as Triton or Agral L.N.	At petal fall and 3 further applications at 10–14 day intervals	
		It may be necessary to follow up the winter sprays with one of the following :—		
Bryobia Mite, Red Spider	White Oil	1–1½ gals. in 100 gals. water	November to early December	Spray as soon as all winter eggs have hatched. Use the weaker strength if weather is unusually warm. Nicotine sulphate at 1 pint per 100 gals. can be added.
	or Parathion	·02–·03% (see spray dilution chart)	November to December	See precautions for use of these materials.
	or Malathion	·06% (see spray dilution chart)	do. do.	
	or Ovotran, P.C.P.B.S. or Chlorparacide	As recommended by manufacturers	Late October to early November	These miticides are mainly effective against the eggs and early stages of the mite and should be applied early. Foliage burn, leaf drop and russetting of fruit may result from use of some miticides on certain varieties. Do not use overstrength sprays.
Thrips	D.D.T.	·1%–½ gal. 20% D.D.T. to 100 gals. water	Pinking	This spray gives good control of thrips, reduces blemish and also helps to control looper caterpillars and jassids.
Looper Caterpillar and Spring Beetle	D.D.T.	do. do.	October or November	D.D.T. gives excellent control but may cause a build-up of Bryobia mite. This spray will help control apple Jassid.
	or Arsenate of Lead	Arsenate of Lead powder, 2 lb. ; White Oil, 1 gal. ; Water, 100 gals.	do. do.	This spray gives good control and does not encourage a build-up of Bryobia mite. Avoid spraying later than December to prevent spray residue on the fruit.
Apple Leaf-hopper (Canary Fly) (Jassid)	D.D.T.	·1%–½ gal. 20% D.D.T. to 100 gals. water	Early November	Spray when first winged Jassids appear. Usually the D.D.T. Looper spray is adequate. A build-up of the Bryobia mite may result from the use of D.D.T.
	or White Oil	White Oil, 1 to 1½ gals.	do. do.	Spray when first winged Jassids appear. Two sprays may be required.
	and Nicotine Sulphate	Nicotine sulphate, 1 pint ; Water, 100 gals.	do. do.	Can be combined with Arsenate of Lead.
		Summer.		
Apple Curculio ...	Dieldrin	·1–·5% (see spray dilution chart)	Just before main emergence of the beetles—Early December	Apply as a butt spray. Use 1 quart per tree. A dieldrin foliage spray (·05%) is also effective, but may cause a build-up of Bryobia mite. See precautions for using Dieldrin.
Pre-Harvest Drop of Apples (mainly Jonathans)	Napthalene acetic acid	10 parts per million. Follow recommendations of manufacturers	Before apples start to drop (about 3 weeks before picking)	Can be followed by a second spray a fortnight later.
Fruit Fly	Sodium Fluosilicate	Use a recognised proprietary foliage bait or the following :— 1 oz. Sod. Fluosilicate 2½ lb. sugar 4 gals. water	At weekly intervals from 6 weeks before fruit is ripe until 2 weeks after harvest	Spray or splash the bait onto the foliage. Observe orchard hygiene—destroy all fallen and infested fruit. See Departmental leaflet on Fruit Fly.

Pest or Disease.	Spray Material.	Concentration.	Time of Application.	Remarks.
		Winter.		
		Follow the schedule recommended for apples.		
San Jose Scale, Bryobia Mite, Red Spider, Pear Leaf Blister Mite	Lime sulphur	14 gals. in 100 gals. water (1–7)	August to early September.	
		Spring and Early Summer.		
Pear Scab (Black Spot)	1. Captan	1½–2 lb. in 100 gals. ...	Spur Burst .... and	Modern scab fungicides are of two types :—
	or			
	Captan + Phenyl Mercury Chloride	*See* under Remarks	Early Pink Bud Stages	*Protectants*—such as Captan, Ziram and Thiram ; and
	or			*Eradicants*—such as the Phenyl mercuries.
	Ziram	According to makers' recommendations		Protectant fungicides give best results when applied before infection occurs, *i.e.*, before rain—Eradicant fungicides will eradicate recent infections but are not long lasting. In recent Departmental experiments Captan has proved superior to Ziram and Thiram compounds and best results have been obtained from mixtures of Captan (1¼ lb.—100) + Phenyl Mercury. The amount of Phenyl Mercury will depend on brand used but is approximately half normal concentration. Owing to possible injurious effects on some varieties, Phenyl Mercuries are at present not recommended after petal fall.
	or			
	Thiram	do. do. do.		
	2. Captan	1½–2 lb. in 100 gals.	Blossoming	
	3. Captan	do. do.	Petal fall	
	or			
	Captan + Phenyl Mercury	*See* under Remarks	do.	
	or			
	Ziram	According to makers' recommendations	do.	
	or			
	Thiram	do. do. do.	do.	
	4. Captan	1½–2 lb. in 100 gals.	Cover sprays at 10–14 day intervals, as required	
	or			
	Ziram	According to makers' recommendations	"	
	or			
	Thiram	do. do. do.		
				Note.—That Captan can be applied safely during blossoming when due to long interval between sprays, heavy infection may occur.
		It may be necessary to follow up the winter sprays with sprays during spring. If so, use one of the following :—		
Pear Leaf Blister Mite	Lime sulphur	1 in 75, or 1⅓ gals. in 100 gals. water	Pinking	Foliage burn is likely to result if spraying is left too late.
	or			
	Nicotine sulphate (Black leaf 40) plus	1 pint in 100 gals. water	When damage first appears	Can be combined with Arsenate of Lead spray for pear slug.
	White Oil	1–1¼ gals. in 100 gals. water		
Pear Slug	DDT	0·1%–½ gal. 20% DDT in 100 gals. water	On appearance of pest—October or November	
	or			
	Arsenate of Lead	2 lb. Arsenate of Lead powder per 100 gals. water, plus 1 gal. white oil as a spreader	do. do. do.	Avoid spraying later than December to prevent spray residue on fruit.
		Summer.		
Curculio Beetle ...	Dieldrin	0·1–0·5%—*see* spray dilution chart	Just before main emergence of beetles—early December	Apply as a butt spray—1 quart per tree. *See* precautions for use of Dieldrin.
Pre-Harvest Drop of Bartlett Pears	Napthalene Acetic Acid	Mixed as directed	Just before fruit starts to drop	
		Autumn.		
Pear Scab (Black Spot)	Phenyl Mercury Chloride	0·05%–0·1% active ingredient	Before leaf fall in autumn	After seasons of severe scab occurrence, carry-over of the disease may be greatly reduced by applying an eradicant phenyl mercury spray at strong concentration. In this case, thorough coverage of leaves is essential. This method should only be regarded as supplementary to the spring spray schedule.

STONE FRUIT

Pest or Disease.	Spray Material.	Concentration.	Time of Application.	Remarks.
		Autumn and Winter.		
Shot-hole	Bordeaux Mixture	6 : 4 : 50, plus ½ lb. calcium caseinate as a spreader	Leaf-fall	Spray before majority of leaves have fallen. This spray is the most important spray for shot-hole control.
Leaf Curl	do. do.	do. do.	Any time during dormant period from leaf fall onwards, but *before bud burst*	This spray thoroughly applied will give practically 100% control of leaf curl. For dual control of shot-hole and leaf curl, an autumn leaf-fall application is preferred.
Rust	do. do.	do. do.	Leaf-fall	Effective also against shot-hole and leaf curl.
San Jose' Scale, Red Spider	Dormant oil or	5 gals. in 100 gals. water	Late dormant	
	DNC Winter oil or	do. do.	July	In areas where delayed foliation occurs.
	Superior oil or	3 gals. in 100 gals. water	Late dormant	Can be used nearer to bud burst.
	Commercial lime Sulphur	14 gals. in 100 gals. water	Prior to bud burst	Apply as late as possible in dormant period—when buds begin to swell. This spray is also effective against leaf curl. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
		Spring.		
Shot-hole	Bordeaux mixture	6 : 4 : 50, plus ½ lb. calcium caseinate as a spreader	Early pink bud	This spray is necessary for shot-hole control in addition to the autumn spray.
	Thiram	1½ lb. in 100 gals.	Petal fall and at 14-day intervals if required	The number of sprays required subsequent to petal fall will depend on weather conditions. Thiram does not damage leaves or fruit.
Leaf Curl	Bordeaux mixture	See autumn-winter control measures.		
Rust	do. do.	6 : 4 : 50, plus ½ lb. calcium caseinate as a spreader	Early pink bud	Effective also against shot-hole.
	Thiram	1½ lb. in 100 gals. water	Petal fall with subsequent cover sprays at monthly intervals if required	do. do. do.
	It may be necessary to follow up the winter sprays with one of the following :—			
Red Spider	Lime sulphur or	1 in 100 plus ½ lb. calcium caseinate as a spreader	Late Octover or November	For peaches, almonds and plums, only. Lime sulphur must not be used on apricots. Overstrength sprays may cause foliage burn.
	Parathion or	·02–·03% (see dilution chart)	November or December	See precautions.
	Malathion or	·06% (see dilution chart)	do. do.	
	Ovotran P.C.P.B.S. Chloroparacide Aramite	As recommended by manufacturers	Late October to early November	Overstrength sprays may cause foliage burn.
Peach Aphis	White oil plus	1 gal.	After blossoming on appearance of aphis	A second spray may be required. Dormant oils also help control this pest.
	Nicotine sulphate or	1 pint in 100 gals. water		
	Parathion or	·01% (see dilution chart)	do. do.	
	Malathion or	·02–·03% (see dilution chart)	do. do.	See precautions.
	H.E.T.P.	·01% (see dilution chart)	do. do.	
		Summer.		
Fruit Fly	Sodium fluosilicate	Use a recognised proprietary foliage bait or the following :— Sodium fluosilicate, 1 oz. Sugar, 2½ lb. Water, 4 gals.	At weekly intervals from 6 weeks before fruit is ripe until 2 weeks after harvest	Spray or splash the bait on to the foliage. Observe orchard hygiene—destroy all fallen and infested fruit. See Departmental leaflet.
Curculio and Fuller's Rose Weevil	Dieldrin	·1–·5% (see dilution chart)	December	Spray the butt of the tree only Use 1 quart per tree. A foliage spray (·05%) may be necessary for Fuller's Rose Weevil. See precautions for using Dieldrin.
Rutherglen Bug	D.D.T. or	·1–·2% (¼–1 gal. 20% D.D.T. in 100 gals. water)	When pest appears	The stronger solution is suggested if the pest is particularly troublesome.
	Malathion or	·05% (¾ pint 50% Malation in 100 gals. water)	do. do.	
	Malathion plus D.D.T.	¾ pint 50% ¼ gal. in 100 gals. water		

CITRUS

Pest or Disease.	Spray Material.	Concentration.	Time of Application.	Remarks.
		Spring.		
Aphis	Nicotine sulphate (Black Leaf 40)	1 pint in 100 gals. plus 1 pint liquid detergent or 1 gal. white oil as a spreader	On appearance of aphis	A second spray may be required.
	or			
	Parathion	0·01%. *See* dilution chart	do. do.	*See* precautions for use of these materials.
	or			
	Malathion	0·02%. *See* dilution chart	do. do.	
	or			
	H.E.T.P.	0·01%. *See* dilution chart	do. do.	
White Fly	White Oil and Nicotine sulphate	2½ gals. in 100 gals. water 1 pint,	When the main emergence of adults is completed (2–3 weeks after large numbers appear)	A second spray may be required in case of severe outbreak. The underside of the leaves should be sprayed thoroughly.
	or			
	Parathion	0·01–0·02%. *See* dilution chart	do. do. do.	*See* precautions.
	or			
	Malathion	0·04%. *See* dilution chart	do. do. do.	
	or			
	H.E.T.P.	0·02%. *See* dilution chart	do. do. do.	
Brown Rot	Bordeaux mixture	4 : 4 : 50. Add white oil (1 in 100) or calcium caseinate (1 lb. in 100 gals.) as a spreader	Early August	Thoroughly spray lower two-thirds of tree. A spring application of Bordeaux is especially important for lemons.
		Summer.		
White Wax Scale	White Oil	2½ gals. in 100 gals. water	When young scales first appear on leaves (Dec. and Jan.)	Two sprays a fortnight apart give best results. Spraying must be thorough. Avoid spraying in heat or when trees are stressed for water. This spray will also help control red scale.
	or			
	White Oil and Soda-ash	2½ gals. 25 lb. (or 60 lb. washing soda) in 100 gals. water	March to early April	A successful spray for later in the season. Should not be applied later than mid-April. Spraying must be thorough.
	or			
	Soda-ash plus liquid detergent	7½ lb. 1 pint in 100 gals. water	do. do.	Eliminates the use of white oil and hence reduces the susceptibility to water spot.
Red Scale and Black Scale	White Oil	2½ gals. in 100 gals. water	When scales are emerging (Jan., Feb., Mar., for red scale, Dec. for black scale)	Spray thoroughly. Heavy infestations may require two sprays. Avoid spraying in heat or when trees are stressed for water.
	or			
	Parathion	0·075–0·1%. *See* dilution chart	do. do. do.	*See* precautions for use of these materials.
	or			
	Malathion	0·1–0·2%. *See* dilution chart	do. do. do.	Parathion may cause a build-up of soft brown scale. White oil or malathion are preferable where this scale is present.
Soft Brown Scale	White oil	2½ gals. in 100 gals. water	When scales are emerging (about December)	Spray thoroughly. Avoid spraying in heat or when trees are stressed for water.
	or			
	Malathion	0·1–0·2%. *See* dilution chart	do. do. do.	Do not use parathion for soft brown scale.
Slugs and Snails	Bordeaux mixture	4 : 4 : 50	When snails appear	Bordeaux sprays in spring and autumn for brown rot will usually give adequate control.
	or			
	Metaldehyde bait	Metaldehyde 1 lb. Bran 30 lb. Calcium arsenate 2 lb. (or 1 lb. 10% BHC)	do. do.	Mix the bait thoroughly and place heaps around the trees.
Fuller's Rose Weevil	Dieldrin	0·05%. *See* dilution chart	December	Apply as a foliage spray using 1 gal. of spray per tree. The use of dieldrin may cause a build-up of red scale. *See* precautions or using Dieldrin.
Fruit Fly	Sodium fluosilicate	Use a recognised proprietary bait or the following: Sodium fluosilicate 1 oz. Sugar 2½ lb. Water 4 gals.	At weekly intervals from six weeks before fruit is ripe until two weeks after harvest	Spray or splash bait onto the foliage. Observe orchard hygiene. Destroy all fallen and infested fruit. *See* Departmental leaflet on Fruit Fly.
		Autumn.		
Brown Rot	Bordeaux mixture	4 : 4 : 50 Add— Calcium caseinate (1 lb. in 100 gals.) as a spreader	Mid to late April. Preferably before first rains	Spray thoroughly lower two-thirds of tree and soil under the branches. This spray is particularly important for oranges and mandarins.
		Winter.		
Pre-harvest Drop of Washington Navels	2, 4–D	*See* manufacturer's recommendations	June	Thoroughly wet leaves and fruit.

BEEF CATTLE STUDIES

"NARRA TARRA," Geraldton, W.A.

By G. L. THROSSELL, B.Sc. (Agric.),
Regional Agricultural Adviser

BEEF cattle studies were carried out at "Narra Tarra," Geraldton, between April 1951 and March 1955. These were part of a project established in the southern States of Australia to obtain factual data on the growth performance of cattle under existing systems of management and thereby to indicate ways and means for increased efficiency in beef production. Three centres were established in the south-western portion of Western Australia and of these, the most northerly was that on "Narra Tarra," the property of Messrs. E. & F. Green.

A suitable cattle weighbridge was installed early in 1951 by the Australian Meat Board, supported by financial assistance from the Commonwealth Bank. The project was supervised by officers of the Department of Agriculture.

This report summarises data collected at monthly intervals during the investigation on groups of cattle grazing improved pastures on this property.

DESCRIPTION OF PROPERTY

"Narra Tarra" is situated close to Geraldton, 312 miles north of Perth. It is located 11 miles north-east of the port, and eight miles inland from the coast. It is a well-developed property of approximately 9,000 acres, about 7,000 of which are cleared, with approximately 6,000 acres under improved subterranean clover pastures, as well as 200 acres of lupins. The original vegetation was principally black wattle (*Acacia*), kerosene bush (*Dryandra*) and other native scrubs. The soil varies from red sandy loams to yellow sands, soil types very suitable for sub-clover. The Chapman River flows through the property and provides stock water throughout the year.

Four thousand acres are top-dressed annually in the autumn with 1 cwt. of superphosphate per acre. A ley system of cropping is now practised and about 500 acres of cereals, mainly oats, are grown on land which has been down to clover for at least four years. High yields of hay and grain are achieved as a result of the build-up in the soil fertility. Fodder conservation receives particular attention, and large tonnages of cereal and meadow hay are baled for feeding back to the stock in the autumn.

The carrying capacity of "Narra Tarra" is one sheep to the acre all the year round. A flock of 9,000 Merino sheep, principally of Koonoona blood, are run, and 2,000 lambs are reared annually.

In addition to sheep, "Narra Tarra" carries a herd of Aberdeen-Angus cattle. Approximately 180 cows are mated annually betwen August and October and the calving percentage averages 90 per cent. In good seasons the calves remain with their mothers until sold at 9 to 11 months of age, but in unfavourable years, they are early weaned and later sold at 12 to 14 months.

METEOROLOGICAL

The rainfall of "Narra Tarra" is principally of the winter type, falling mainly during the months of May to October; the rest of the year being practically rainless. The winters are mild, providing good growing conditions, but the summers are hot and dry. The average annual rainfall of "Narra Tarra" is approximately 18 inches. The monthly rainfall recorded at the homestead, during the course of the project is shown on the following page.

"NARRA TARRA" RAINFALL.

Year.	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
1951	....	16	6	274	246	776	559	336	101	37	9	84	2,444
1952	6	25	25	36	379	316	385	160	136	73	24	8	1,573
1953	....	....	142	101	551	481	381	94	56	123	49	....	1,978
1954	28	....	....	70	261	200	376	165	68	39	....	....	1,207
1955	....	596	....	284	....	....	....	....	....	....	....	....	....

Further meteorological data from the Geraldton aerodrome, situated approximately six miles south of "Narra Tarra," is summarised as follows:—

METEOROLOGICAL DATA—GERALDTON AERODROME.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
Mean Maximum.												
1951	81·4	88·1	86·7	81·0	73·1	67·3	65·6	67·2	72·8	75·2	79·1	81·6
1952	88·7	90·6	89·0	84·5	73·6	70·9	66·4	69·1	71·1	75·6	76·2	82·8
1953	88·4	85·9	83·5	80·0	74·3	67·8	66·7	68·9	73·3	72·8	79·4	81·8
1954	89·3	91·3	84·4	80·1	73·6	68·3	67·4	67·8	72·9	77·9	74·3	83·3
Mean Minimum.												
1951	62·3	66·1	63·1	60·6	51·6	51·3	46·2	46·0	49·0	50·4	55·4	60·4
1952	63·7	68·6	64·3	63·1	54·5	52·0	45·9	45·5	48·6	50·4	55·4	59·3
1953	63·7	63·9	64·9	59·1	54·1	50·6	48·8	45·2	47·8	51·7	55·6	58·7
1954	67·2	65·5	61·1	55·1	62·8	48·3	49·4	45·7	47·8	53·2	65·6	60·7
Extreme Maximum.												
1951	94·0	107·8	102·1	95·0	82·4	71·9	70·4	78·3	87·4	99·3	101·9	104·1
1952	109·8	107·1	104·5	99·9	81·9	79·0	73·8	77·2	90·8	90·8	95·2	107·2
1953	108·1	101·6	99·9	96·2	86·3	75·0	71·9	78·8	89·9	88·1	95·9	106·1
1954	117·9	108·8	107·6	94·0	87·0	72·8	75·8	72·2	89·9	96·4	85·7	107·6
Extreme Minimum.												
1951	53·3	52·2	54·1	47·0	44·0	41·2	34·0	38·9	41·2	40·4	46·2	50·9
1952	54·8	55·0	52·8	54·2	40·9	46·2	39·8	40·9	38·3	42·6	44·9	45·8
1953	53·3	57·2	57·8	50·6	44·6	42·8	37·6	38·9	35·9	43·8	47·3	47·9
1954	57·0	54·4	53·2	45·2	43·4	42·0	40·2	37·8	37·0	46·1	48·2	48·4

Rainfall.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
1951	2	14	57	362	148	807	547	250	131	48	9	91	2,466
1952	11	5	12	30	257	255	374	122	72	65	20	16	1,239
1953	....	19	131	163	594	532	342	121	69	81	38	....	2,090
1954	40	....	....	50	236	172	369	193	80	60	12	1	1,213
9-yr. Average	18	25	41	106	288	429	376	231	104	54	30	20	1,722

DETAILS OF PROJECT

The project commenced on April 3, 1951, and finished on March 2, 1955.

It was decided to commence with two groups of cattle—one group of weaners, termed the growing group, and the other of older cattle—called the fattening group.

The first growing group comprised 16 grade Aberdeen-Angus steers 8 to 10 months of age, which had been weaned the day before.

In order to make up a fattening group, 25 two-year-old Beef Shorthorn steers were purchased. These were bred at "Murgoo" Station, situated approximately 200 miles north-east of Geraldton. All other groups in subsequent years were grade Aberdeen-Angus bred on "Narra Tarra."

The cattle in each group were firebranded with 2½in. numerals on the nearside rump. Later, in an endeavour to save time in identification, corresponding numbered ear tags were placed in the nearside ear. This, however, was unsatisfactory owing to the tags becoming dislodged in the scrub, etc. It was found more satisfactory to clip around the brands periodically.

The two groups were run together in the one mob, and were pastured throughout on improved top-dressed pastures. Sheep were frequently run in the same paddocks. Weighings were made at approximately 28-day intervals.

At the end of each phase of the investigation terminating in the slaughter of the fattening group, the preceding year's growing group became the current year's fattening group and a new growing group was selected from cattle on the property.

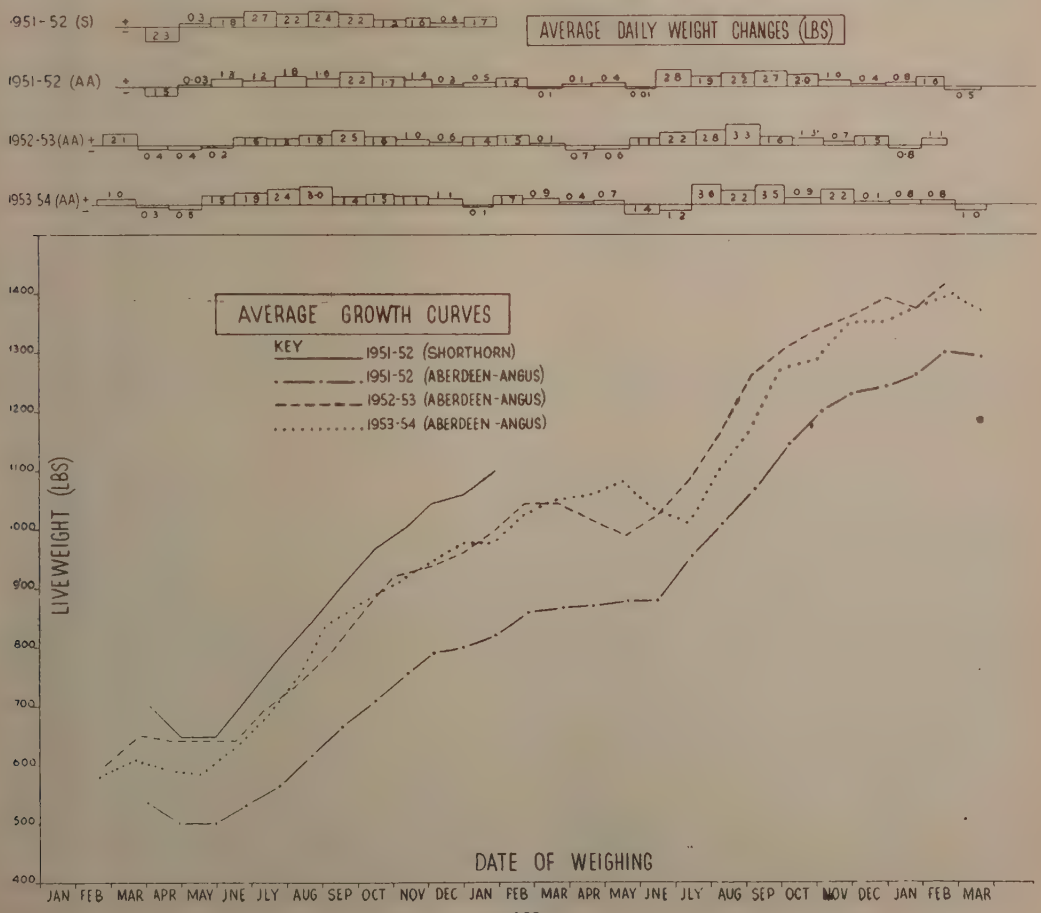
Four cycles have now been completed, so that data are available of the monthly growth rate of four groups of bred steers, over a period of 24 months after weaning.

Graphs showing average growth curves and daily growth rates have been prepared and accompany this article.

At the completion of each two-year cycle (excepting in the first year when the initial fattening period was 301 days), the fattening groups were sold to a local butcher, and were slaughtered at his yards. It was not possible to slaughter the whole group in one day, owing to limited cool storage space and killing usually extended over a week to ten days. The cattle, however, were weighed prior to slaughter and, later as cold dressed carcasses.

1951 RESULTS

The 1951 season was above average. The opening rains commenced the first week in April, six weeks earlier than usual, and green feed was available towards the end of the month and was kept going by following rains. A wet winter was experi-



enced, but September and October were below average. However, there was abundant moisture available and a very good season resulted.

The growing group, numbering 16, at 8 to 10 months had an initial live weight of 536 lb. By January 29, 1952, the liveweight had risen to 821 lb. an increase of 285 lb. in 301 days, equivalent to a daily live weight increase of 0.95 lb. per head.

The fattening group, comprising 25 two-year-old Beef Shorthorn steers initially weighed 704 lb. and at the completion of the test, weighed 1,105 lb., an increase of 401 lb., representing a daily growth rate of 1.3 lb. per head. This group was slaughtered from February 26, to March 7, 1952, their weight prior to slaughter being 1,101 lb. and dressed weight 561 lb.—which equals 50.8 per cent. dressed weight The data are summarised as follows:—

1951 RESULTS.

Commenced 3rd April, 1951; finished 29th January, 1952 (301 days).

	Initial Weight.	Final Weight.	Increase.	Increase per Day.
	lb.	lb.	lb.	lb.
Growing (16 Aberdeen-Angus)	536	821	285	0·95
Fattening (25 Shorthorns)	704	1,105	401	1·3

Comments on Growth Rate.

The commencement of the project on April 3, 1951, almost coincided with the opening rains, and, as frequently happens the cattle on pasture lost weight in the first month after rain. At the second weighing, the growing group had lost 43 lb. and the fattening 65 lb., but at the next weighing 56 days after the opening rains when green feed was available, both groups had commenced to put on weight, and by June weighing had gained 47 lb. and 61 lb. per head. This gain in weight continued in both groups, the growing animals making slightly less gains per head than the fattening group. Growth then corresponded with the pastures, reaching its maximum in the spring and

Portion of the Narra Tarra herd of Aberdeen-Angus cattle

slowing down as the feed dried off and the weather became warmer.

1952 SEASON'S RESULTS

This season, unlike the previous one, was well below average the total rainfall being approximately three inches below normal. The season opened about three weeks early and good follow-up rains continued. The winter rains were not as heavy as the previous year and the spring rains persisted up to the end of September. Feed conditions were good throughout.

The 1951 growing group became the fattening group, the average weights on February 25, 1952, being 858 lb. At the completion of the trial on February 21, 1953, this group had grown to 1,302 lb., an increase of 444 lb. per head, which for the 361 days is equal to a daily increase of 1.2 lb. per head. This group was held until March and slaughtered, the respective weights then being:—

	lb.
Average live weight	1,290
Average dressed weight	711
Percent dressed weight	55.1

These high dressing percentages were the result of carrying the steers to a post-fattening stage and finishing up with steers which were carrying too much fat for the trade. Such animals inevitably have a high dressing percentage.

The growing group comprised 24 Aberdeen-Angus weaners 8 to 10 months old, and average 592 lb. liveweight. The respective weights for this group were:—

	lb.
Initial weight	592
Final weight	1,031
Increase	439
Daily increase per head	1.2

These results are summarised:—

1952–53 RESULTS.

Commenced 25th February, 1952; finished 21st February, 1953 (361 days).

——	Initial Weight.	Final Weight.	Increase.	Daily Growth Rate per Head.
	lb.	lb.	lb.	lb.
Growing (24 Aberdeen-Angus)	592	1,031	439	1·2
Fattening (16 Aberdeen-Angus)	858	1,302	444	1·2

Comments on Growth Rate.

The growing group at the commencement of this trial remained on their mothers for a further month, and as a result, gained 59 lb. They then lost weight slightly over the next two months. Owing to some supplementary hay feeding after the opening rains, the cattle held their weights, and by the July weighing showed a substantial increase. The cattle continued to increase in weight throughout the winter and spring, maximum growth being recorded in September and October, and owing to the mild summer growth continued until March.

1953 SEASON

This season was another early one, the opening rains falling the third week in March. After three weeks dry weather an inch of rain fell in mid-April, which kept the feed going well until the real winter rains commenced the first week in May.

The falls of May, June and July were good for both pastures and stock, and although August and September were below average, good October rains fell, finishing off a good stock year, the rest of the season being practically rainless.

The 1953 growing group comprised 24 Aberdeen-Angus weaners 8 to 10 months old. The growing group of 24 from the

previous year's work, became the fattening steers group, and data were collected on this and the new growing group until April 1954. The results are as follows:—

1953–54 RESULTS.

Commenced 21st February, 1953; finished 22nd February, 1954 (376 days).

	Weight.	Final Weight.	Increase.	Daily Growth Rate per Head.
	lb.	lb.	lb.	lb.
Growing (24 Aberdeen-Angus)	576	1,024	448	1·2
Fattening (24 Aberdeen-Angus)	1,031	1,407	376	1·0

The fattening group were held until mid-April, by which time they had increased to 1,447 lb. These dressed out at 855 lb. equivalent to 59.1 per cent. carcass weight.

Comments on Growth Rate.

The static summer period at the commencement of this series of tests, was shorter this year owing to the early rains in March. As previously observed the weaners in the growing group which remained on their mothers for the first month gained 1 lb. per day, while the fattening group gained only 0.1 lb.

Following the opening rains they lost weight slightly, but again—within 56 days—commenced gaining rapidly. This year the daily growth rate was higher than previously, reaching 3 lb. and 3.3 lb. per head for the growing and fattening groups respectively in August. Owing to the light September rains, the growth rate next month almost halved, but on account of the good October rains, the best during the project, growth continued well into the summer which was much cooler than the previous.

1954 SEASON'S RESULTS

This season was the lightest rainfall year during the trial, only 12.07 inches being recorded. The season opened normally the third week in May, and good winter rains were experienced. However, the season practically finished after the third week in August, only very light rains falling during September and October, while November and December were rainless.

After a dry January, abnormally heavy summer rains amounting to 596 points fell during February, which spoilt the dry feed and caused a premature germination of pastures, much of which did not survive the hot dry weather which followed.

There was no growing group in 1954, the 1953 growing group comprising 24 Aberdeen-Angus steers became the 1954 fattening group. The duration of this period was from February 22, 1954 to March 21, 1956—392 days.

The results are as follows:—

1954–55 RESULTS.

Commenced 22nd February, 1954; finished 21st March, 1955 (392 days).

	Initial Weight.	Final Weight.	Increase.	Daily Growth Rate per Head.
	lb.	lb.	lb.	lb.
Fattening (24 Aberdeen-Angus)	1,024	1,370	346	0·9

The cattle were held until April, being slaughtered between the 19th and 26th of that month.

Comments on Growth Rate.

As has been noticed in previous years, the cattle were gaining slightly during the autumn months, until the May rains when they lost weight again for the next two months. During August and September their growth rate reached the maximum for the trial, but on account of lack of spring rains affecting the feed, the growth rate slowed down. The heavy February rains spoilt the dry feed, causing further loss in weight.

The growth curve is again very uniform.

The following is a summary of the data of each year:—

SUMMARY OF GROWING GROUPS.

Group and Year.	Days in Experiment.	Liveweight.			
		Initial.	Final.	Total Increases.	Mean Daily Increase.
		lb.	lb.	lb.	lb.
1. 1951	301	536	821	281	0·95
2. 1952	361	592	1,031	439	1·2
3. 1953	376	576	1,024	448	1·2

SUMMARY OF FATTENING GROUPS.

Group and Year.	Days in Experiment.	Liveweight.				
		Initial.	Final.	Total Increase.	Mean Daily Increase.	Dressing.
		lb.	lb.	lb.	lb.	%
1. 1951	301	704	1,105	401	1·3	50·8
2. 1952	361	858	1,302	444	1·2	55·1
3. 1953	376	1,031	1,407	376	1·0	59·1
4. 1954	392	1,024	1,370	346	0·9	58·3

To summarise the results of the four years' project, the growth curves resulting from the data obtained are very uniform.

Under the conditions at "Narra Tarra" most years, there appears to be three definite growth periods, coinciding very closely to that of the pastures; namely the autumn, winter and spring, and the summer periods.

During the autumn months the cattle hold their weights or only lose very slightly until the opening rains, when, without supplementary feeding, they lose rapidly for two months. As soon as the green feed becomes available they gain rapidly, reaching a maximum daily growth rate of between 2 and 3 lb. per head in August and September, depending on the season. As the pastures decline in value and as the temperature increases, the growth rate slows down but continues until the autumn months.

No attempt was made to study the effect of supplementary feeding during the autumn months. The economics of this and other aspects of management are worth investigating.

This project highlights an outstanding achievement of Messrs. Green, in pasture development on "Narra Tarra."

ACKNOWLEDGMENT

The Department of Agriculture acknowledges its indebtedness to Messrs. E. and F. Green for making their property and stock available for the project. Their willing co-operation and assistance throughout was very much appreciated.

Thanks are also extended to Mr. A. Waller, at whose premises the cattle were slaughtered and carcasses weighed.

Thanks are also due to the officers of the Geraldton Regional Office for assisting in the supervision of the project.

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HOW TO MAKE AND USE THE 90 DEGREES V-NOTCH

By A. H. BOSCH, Irrigation Technician

WHEN irrigating by means of a pump delivering water from a river or creek, the first thing to be done is to have the area to be irrigated surveyed. From this survey it can be seen where the head-ditch will have to be placed. Where the land slopes away from the river, there is generally a high ridge between the river and this land. The right position for the head-ditch is just over the ridge, away from the river as shown in Fig. 1. This is necessary to prevent erosion of the bank in the event of a break occurring in the head-ditch. As soon as the head-ditch has been set out, the position of the stilling pool is indicated, as this is at the highest point on the head-ditch. This point is sometimes at the beginning, or somewhere towards the middle of the head-ditch.

The position for the pump is now selected; this will be near a good pool with a slope which will allow easy access, and room enough for good installation; close to the water and not too far above the water-level. About 15ft. above the water-level is the limit to get the best results from the pump.

The next step is to set out the delivery pipe-line, from the stilling pool to the pump, in a straight line, avoiding bends and angles.

The survey will show, how many acres can be irrigated and how much water will be needed, and hence the size of the pump. And this again decides the size of all the piping. All this information is available to farmers through the Irrigation Branch of the Department of Agriculture which, in addition, will supply a precise lay-out,

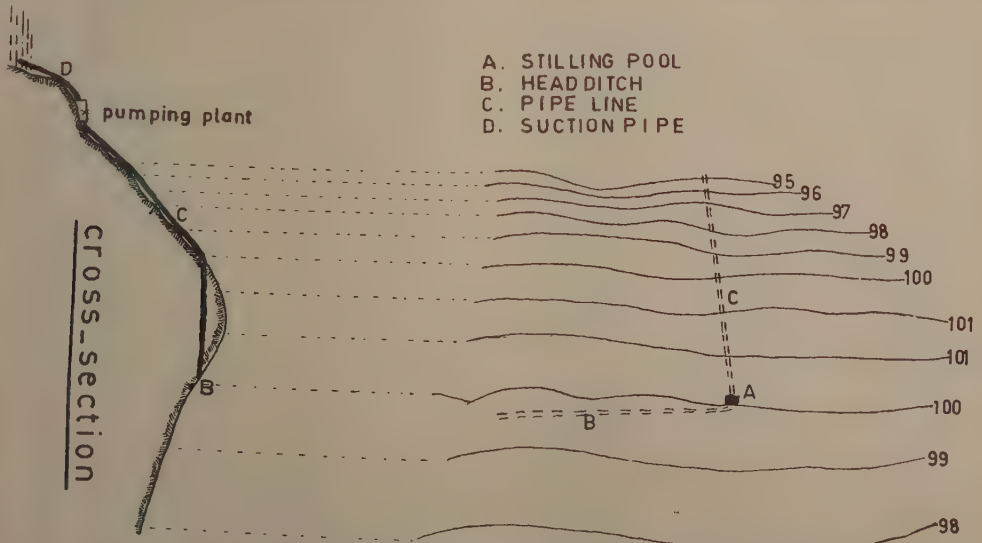

Fig. 1.—Diagram showing desirable positions for pump, stilling pool, head-ditch, etc.

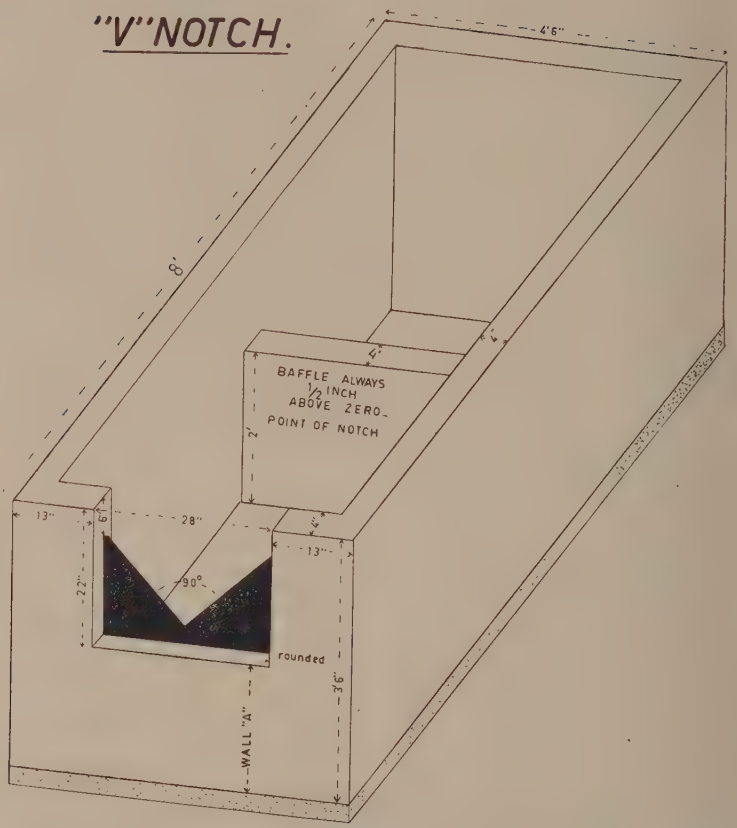

Fig. 2. — Isometric drawing showing details of stilling pool with V-notch.

and give advice as to grading, and check the grading as it takes place.

The need for a stilling pool is obvious. The pump gives to the water which is being discharged a whirling velocity, which, if it were led straight into the head-ditch, would cause severe washing away and scouring, and the velocity in the head-ditch would be too great to permit control of the water. An ordinary stilling pool is very simple to construct, and the size is of no great consequence, provided that the outlet from the stilling pool into the head-ditch is large enough to discharge the water at a rate equal to, or greater than that at which it enters the stilling pool through the supply pipe from the pump. If it is smaller, the water will of course rise in the stilling pool until it flows over the sides.

MEASURING THE WATER SUPPLY

When an irrigator purchases a pump, the makers generally quote the number of gallons per hour the pump will supply at a certain number of revolutions. In practice this figure is seldom accurate, being subject to many factors such as unaccounted-for friction and resistance, alteration of revs. which go unnoticed, belt slip, and so on. An irrigator wants to know how much water he really is getting and how much water he really uses on his pastures, and therefore it is necessary that he be provided with a reliable means of measuring the flow.

Measuring of water can be done in several different ways, but for our purpose the most accurate gauging can be done by means of the sharp-edged triangular 90° V-notch.

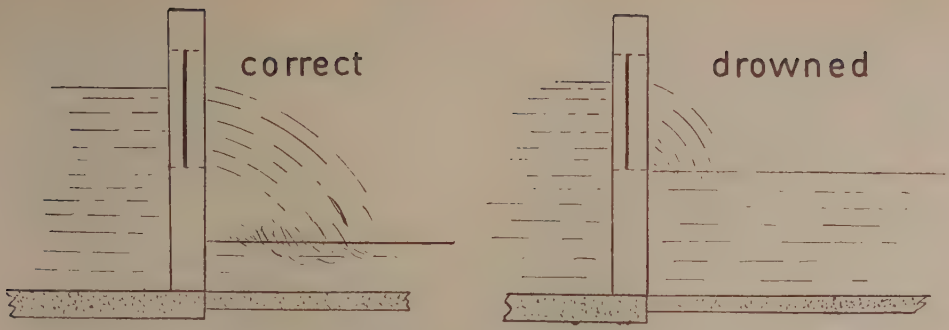

Fig. 3.—At least eight inches of free fall is required on the outflow side of the notch.

Such a V-notch can be installed permanently at the end of the stilling pool (see, Fig. 2) and every drop of water before it enters the head-ditch, passes through this notch.

To ensure the proper working of the V-notch, the all-important factor is that the water leaving the notch must have a free fall of at least 8in. If this is not provided, the notch cannot gauge accurately and may even become "drowned," and useless. (Fig. 3.)

When due attention is paid to this free fall, then the only other thing needed is to place a graduated scale in the stilling pool a short distance back from the V-notch, so as to be out of the area where downslope towards the notch occurs. And to be able to read the gauge properly, it is necessary that the water should be calm.

For this reason a baffle is put in the stilling pool, to check the velocity and turbulence of the incoming water. As the water flows over the baffle, it leaves the surface of the water between the baffle and the V-notch practically calm and enables us to read on the gauge the exact depth of water that is flowing over the V-notch.

This knowledge, as described later, can be used to give the number of gallons per hour that is being pumped, or the acre-inches being delivered.

MAKING THE STILLING POOL

As will be seen from Fig. 2, the outside measurements of the pool are 8ft. x 4ft. 6in. All walls are 4in. thick and the bottom is 3in. thick. The baffle is 4in. thick and is located 3ft. from the V-notch end of the pool and 4ft. from the end which takes the delivery pipe from the pump.

The delivery pipe may enter through the end or the side, near the bottom of the pool, and always behind the baffle.

The depth of the pool will be influenced by the depth of the head-ditch. In the diagrams we have shown this as 12in. (Figs. 2 and 4) but this can be variable and Table A shows the wall heights for four different depths of head-ditch.

For the 12in. deep head-ditch we excavate to a depth of 15in. which is the 12in. actual depth plus 3in. for the thickness of concrete at the bottom of the pool.

Concrete Used.

The stilling pool requires about 39 cubic feet of concrete made from 1 part cement; 1½ parts sand and 3 parts coarse aggregate. About 9 cubic feet will be needed to put in the bottom of the pool.

The V-notch.

This is made from an 18in. x 32in. sheet of heavy-gauge flat iron such as could be obtained by flattening a section cut from a 44 gallon drum. The actual notch is cut on a perfect right-angle (90 degrees) and is 13in. deep and 26in. wide as shown in Fig. 4. The point at the lowest part of the notch is 3in. above the concrete, and a 2in. flange below this, and at the sides of the plate, is inserted into the concrete to hold it firmly in position.

The edges of the V are bevelled to a knife-edge with the bevel on the outside or downstream side of the pool. The

shoulders of the V-notch must be perfectly level.

The Gauge.

Used in conjunction with the V-notch is the graduated scale previously referred to. This is simply a length of flat iron, steel rod, or piping inserted as a permanent fixture in the concrete to indicate the depth of water flowing through the notch.

It is located between the baffle and the notch and far enough from the baffle to be out of the area where the surface of the water curves downards in the outflow. A suitable position is close to the wall and about a foot back from the notch.

The gauge is set firmly in the concrete bottom of the stilling pool and should be painted, preferably with a bitumastic paint, to prevent rust damage.

The nought or zero mark on the gauge must be on exactly the same level as the lowest portion of the notch where it comes to a point. An accurate method of ensuring this is to fill the pool and allow the water to run until it ceases to overflow the notch. The zero mark is then made on the gauge at water-level and the inch and half-inch marks put in above this point.

Building the Walls.

After the layer of concrete has been put down at the bottom of the excavation, the walls at the sides and back are built up, leaving an opening for the delivery pipe.

The front wall, marked "A" in Fig. 2 needs particular care in its construction. It is first built up to a height of 12in. for a 12in. deep head-ditch (Fig. 4). As the head-ditch in this case is intended to act as an irrigation ditch, the level of the irrigation water is shown 3in. above ground level where it is held by the banks and this had to be taken into considera-

depth ditch	height wall "A"	total height walls
6"	14"	3'
9"	17"	3'3"
12"	20"	3'6"
15"	23"	3'9"

Table A.—Wall heights for different depths of head-ditch.

tion when allowing a full 8in. free fall from the V-notch.

The wall "A" is therefore built to a height of 12in. + 3in. + 5in. or a total height of 20in. and the plate for the V-notch is embedded 2in. so that the lowest portion of the V is 3in. above the concrete. At this stage check the shoulders of the V for level and ensure that the bevel is facing outward.

Now continue to build up the front wall by adding the two side-pieces leaving a space of 28in. in between them to take the 26in. wide V with a 1in. shoulder at each side.

To facilitate the free flow of water from the V, the cement below the V has its edge rounded off, as indicated on Fig. 2.

The Baffle.

This, as stated earlier, is located four feet from the delivery pipe end of the pool and is 4in. thick. It is carried up to a

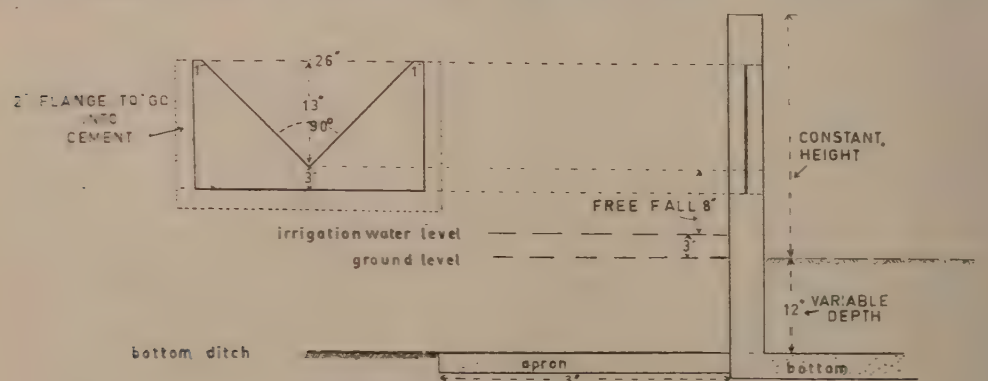

Fig. 4.—Details of the V-notch.

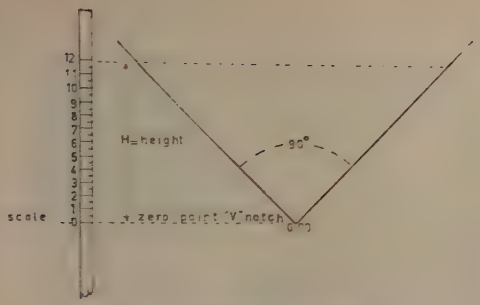

Fig. 5.—Installing the gauge.

height of 1in. above the lowest point of the notch. The baffle does not have to be watertight and may be built of bricks or blocks if desired.

Protection.

Provision must be made to protect the head-ditch from erosion caused by the water falling from the V-notch. A cement apron is laid down so that it is level with the bottom of the head-ditch (see Fig. 4). The side walls of the ditch at this point are also protected by a concrete facing.

MEASURING THE FLOW

To find out how many gallons per hour the pump is delivering, or what this means in terms of inches to the acre, it is only necessary to read the gauge showing the depth in inches of the water passing through the V, and then to refer to Table B.

For example, if the water is up to the 10in. mark, the output is 36,032 gallons per hour or approximately 1.6 inches per acre per hour. At 6½in. the output is 12,400 gallons or half an inch per acre per hour.

TYPES OF DITCHES

Three types of ditches are used in irrigation.

Head ditches receive the water from the Government supply channels or from pumps. They are much bigger than the ordinary irrigation ditches, although they often serve as irrigation ditches and are generally laid so that they are almost following the contour lines but with a gentle fall. They can be deeper than the ordinary irrigation ditches.

Irrigation ditches are the ordinary ditches from which water is taken off to irrigate the pastures, etc. They are small ditches and are usually shallow with banks which hold water above the level of the ground to be irrigated. Irrigation ditches usually are built with only slight fall so that stops are unnecessary.

Connecting ditches usually link up the irrigation ditches and sometimes have so much fall that series of stops have to be inserted. As water is not taken directly from the ditches, this does not matter.

TABLE B.—SHOWING GALLONS AND ACRE-INCHES PER HOUR.

Scale Reading.	Gallons per Hour.	Inches of Cover per Acre per Hour (approx.).
1	292·5	
1½	335·1	
2	668·2	
2½	1,070·4	
3	1,860·0	0·07
3½	2,684·0	0·11
4	3,692·0	0·16
4½	5,053·0	0·2
5	6,515·0	0·3
5½	8,262·0	0·3
6	10,221·0	0·4
6½	12,400·0	0·5
7	15,006·0	0·6
7½	17,803·0	0·8
8	20,802·0	0·9
8½	24.126·0	1·0
9	27,710·0	1·2
9½	31,719·0	1·4
10	36.032·0	1·6
10½	41,738·0	1·8
11	45,611·0	2·0
11½	50.462·0	2·2
12	56,609·0	2·5
12½	62,405·0	2·8

VISION

Due to the vision of Richard Goldsbrough, in Melbourne, over 100 years ago, the wool auction system of Australia commenced. In 1843 Thomas Sutcliffe Mort started the first continuous series of wool auctions in Sydney.

Later a partnership was formed and the foundation of the vast wool-broking organisation of Goldsbrough Mort & Co. Ltd., which has endured and flourished for over a century, was firmly laid.

GOLDSBROUGH MORT

Goldsbrough Mort & Co. Ltd., Perth. Branches & Agents throughout the State.

LIST OF REGISTERED FERTILISERS, 1956-1957

By A K. JONES, Inspector of Fertilisers

THE Fertiliser Act, 1928-1955, requires all fertilisers sold in this State to be registered annually, the registration year commencing on 1st November each year. A list of fertilisers registered for the current registration year appears in this issue. Departmental inspectors carry out regular inspection and sampling of fertilisers to see that those offered for sale comply with the requirements of the Fertiliser Act, including the registered analyses. The knowledge that this work is being carried out, induces manufacturers to maintain their fertilisers close to and usually a little above, the registered standard.

From the fertilisers registered, unit values, i.e., the average commercial value of each one per cent., of a given ingredient per ton of fertiliser, have been calculated for the various forms of the main fertilising ingredients, nitrogen, phosphoric-anhydride and potash. These values are arrived at from the average of prices quoted for each fertiliser at the time of registration and are as follows:—

	s.	d.
Nitrogen (N) as—		
Blood, Blood and Bone, Bone Dust and other animal fertisers	90	8
Nitrate	52	10
Ammonia	40	0
Urea	40	8
Phosphoric Anhydride (P_2O_5) as—		
Water soluble in superphosphate	13	0
Citrate soluble in superphosphate	13	0
Acid soluble in superphosphate and rock phosphate	6	7
Blood and Bone, Bone Dust and other animal fertilisers	22	6
Potash (K_2O) as—		
Sulphate	18	0
Muriate (Chloride)	12	7

From unit values a comparison of the commercial value of fertilisers of similar types can be made. As will be appreciated however, it is not possible to compare, say for example the value of nitrogen in blood and bone with that in sulphate of ammonia.

It should be remembered that unit values are average values arrived at from the prices of all fertilisers registered. The commercial values arrived at from the use of these figures will therefore in some cases be more and in others less than the actual selling price. Other points to be borne in mind are fluctuations which may occur during the year in market values and in the case of mixed fertilisers, e.g., potato manures, the cost of mixing and extra handling which must be added to figures arrived at from the use of unit values.

To calculate the value of a fertiliser from unit values the percentage of each ingredient in the fertiliser should be multiplied by its unit value and the results for each ingredient in the fertiliser totalled. An example of how this can be done and how a comparison of values can be made between fertilisers of similar types is as follows:—

	Nitrogen. %	Phosphoric Anhydride. %
X Brand Blood and Bone	6.5	10.0
Y Brand Blood and Bone	5.5	13.0

The unit values of Nitrogen and Phosphoric Anhydride in Blood and Bone as set out above are 90s. 8d. and 22s. 6d.

respectively. The comparative commercial value of X and Y Brand Blood and Bones would therefore be—

X Brand Blood and Bone.

	s.	d.
6.5 units of Nitrogen @ 90s. 8d. per unit	589	4
10.0 units of Phosphoric Anhydride @22s. 6d. per unit	225	0
Total value	814	4

Y Brand Blood and Bone.

	s.	d.
5.5 units of Nitrogen @ 90s. 8d. per unit	498	8
13.0 units of Phosphoric Anhydride @ 22s. 6d. per unit	292	6
Total value	791	2

The fertilising ingredients contained in X Brand are worth more than those in Y Brand and therefore if the two fertilisers were offered for sale at the same price the X Brand would obviously be the most economical to purchase.

Buyers of fertilisers are advised to consult the list of registered fertilisers and to ensure that packages containing fertilisers are correctly branded and/or labelled, i.e., carry a copy of the registered brand and name, and in the case of fertilisers contained in packages of one cwt. and under, a label setting out the registered analysis, before purchasing same.

If any doubts about a fertiliser arise enquiries should be made at the Department of Agriculture where information on the provisions and requirements of the Fertiliser Act and advice on matters concerning the use of fertilisers can be obtained.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928-1955 for the year commencing 1st November, 1956.

Name of Fertiliser.	Reg. No.	Registered Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
				%	%	%	%	%	%	%	%	%	%	
A. MINERAL.														
1. Nitrogenus.														
(a) *Nitrogen as Nitrate.*														
Sodium Nitrate	10	Faulding....	F. H. Faulding & Co., Ltd.	16·00	....	....	....	....	....	....	....	....	....	£8/8/0 per cwt. (P)
Nitrate of Soda	105	C.S.M.L.	Cuming Smith Mount Lyell	16·00	....	....	....	....	....	....	....	....	....	£42/5/0 (P) £43/10/0 (G) (W) £43/10/0 (B)
Do. do.	135	Symonds....	E. Symonds	16·00	....	....	....	....	....	....	....	....	....	Packets
Do. do.	160	David Gray's	David Gray & Co., Ltd.	16·00	....	....	....	....	....	....	....	....	....	Packets
(b) Nitrogen as Ammonia.														
Ammonium Nitrate	11	Faulding....	F. H. Faulding & Co., Ltd.	....	30·00	....	....	....	....	....	....	....	....	£6/1/4 per cwt. (P)
Sulphate of Ammonia	12	do.	do. do. do.	....	20·00	....	....	....	....	....	....	....	....	£2/15/0 per cwt. (P)

Do. do.	106	I.C.I.A.N.Z.	Cuming Smith Mount Lyell	....	20·50	....	....	....	....	....	....	....	....	£41 (P) £43/10/0 (G) (W) £42/10/0 (B)
Do. do.	124	Blue Cross	Agricultural Products Co.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	134	Symonds....	E. Symonds	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	163	David Gray's	David Gray & Co., Ltd.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	183	Best	William J. Pascoe & Son	....	20·50	....	....	....	....	....	....	....	....	Packets
(c) *Nitrogen as Urea.*														
Urea—N. 46	128	Blue Cross	Agricultural Products Co.	As Urea 46·0*	....	....	....	....	....	....	....	....	....	Packets
2. Phosphatic.														
(a) *Rock Phosphate.*														
Ground Phosphate Rock	14	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	....	....	....	....	36·60	36·60	....	....	£12/2/0 (W) (P)
Do. do. do.	35	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	....	....	....	....	....	....	36·60	36·60	....	....	£12/2/0 (W) (A)
Do. do. do.	54	Sickle	Cuming Smith Mount Lyell	....	....	....	....	....	....	36·60	36·60	....	....	£12/2/0 (W) (P)
Do. do. do.	71	"M.L." in diamond	do. do. do.	....	....	....	....	....	....	36·60	36·60	....	....	£12/2/0 (W) (P)
Do. do. do.	87	C.S.M.L.	do. do. do.	....	....	....	....	....	....	36·60	36·60	....	....	£12/2/0 (W) (P)
(b) *Superhposphate.*														
Superphosphate 23% ..	17	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£14 (W) (P)
Do. do.	37	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£14 (W) (A)
Florida Superphosphate 23%	55	Sickle	Cuming Smith Mount Lyell	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£14 (W) (P)
Superphosphate 23%	73	"M.L." in diamond	do. do. do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£14 (W) (P)
Superphosphate 23%	89	C.S.M.L.	do. do. do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£14 (W) (P)
Superphosphate	120	Blue Cross	Agricultural Products Co.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	138	Symonds....	E. Symonds	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	157	David Gray's	David Gray & Co., Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	182	Best	William Pascoe & Son	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
(c) *Rock Phosphate and Superphosphate.*														
50/50 Mixture	16	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£13/16/0 (W) (P)
Do.	36	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£13/16/0 (W) (A)
Do.	53	Sickle	Cuming Smith Mount Lyell	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£13/16/0 (W) (P)
Do.	72	"M.L." in diamond	do. do. do.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£13/16/0 (W) (P)
Do.	88	C.S.M.L.	do. do. do.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£13/16/0 (W) (P)
3. Potassic.														
(a) *Potash as Muriate.*														
Muriate of Potash	107	Giant	do. do. do.	....	....	....	....	....	....	....	....	....	58·00	£36/10/0 (P) (W)
Do. do.	108	Sun	do. do. do.	....	....	....	....	....	....	....	....	....	58·00	£38 (B) (W) £36/10/0 (P) (W) £38 (B) (W)
Do. do.	123	Blue Cross	Agricultural Products Co.	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	137	Symonds....	E. Symonds	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	162	David Gray's	David Gray & Co., Ltd.	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	184	Best	William J. Pascoe & Son	....	....	....	....	....	....	....	....	....	58·00	Packets
(b) *Potash as Sulphate.*														
Sulphate of Potash	109	Sun	Cuming Smith Mount Lyell	....	....	....	....	....	....	....	....	48·00	....	£43/5/0 (P) (W) £45/15/0 (G) (W) £44/10/0 (B) (W)
Do. do.	136	Symonds....	E. Symonds	....	....	....	....	....	....	....	....	48·00	....	Packets
Do. do.	161	David Grays	David Gray & Co., Ltd.	....	....	....	....	....	....	....	....	48·00	....	Packets

* Nitrogen (N) as Urea. A denotes Albany. B denotes Bunbury. P denotes Perth. G denotes Geraldton.

FERTILISERS—continued.

Name of Fertiliser.	Reg. No.	Registered Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
				%	%	%	%	%	%	%	%	%	%	
4. Nitrogen and Phosphoric Anhydride.														
Garden Fertiliser	4	Sound	Cockburn Sound Fertilisers	....	..	4·0	..	3·0	1·0	2·0	6·0	....	....	£25 (W)
Potato Manure C	30	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	3·50	....	..	14·00	2·50	2·25	18·75	..	....	£20/18/6 (W) (P)
Do. do.	49	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£21/9/3 (A) (W)
Do. do.	67	Sickle	Cuming Smith Mount Lyell	....	3·50	..	....	14·00	2·50	2·25	18·75	....	....	£20/18/6 (W) (P)
Do. do.	80	"M.L." in diamond	do. do. do.	....	3·50	..	..	14·00	2·50	2·25	18·75	....	..	£20/18/6 (W) (P)
Do. do.	102	C.S.M.L.	do. do. do.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£21/7/3 (G) (W) £21/3/9 (P.J.) (W)
Lawn Manure	168	Dawn	Dawn Fertilisers	....	5·75	....	....	8·75	2·0	1·75	12·50	....	....	Packets
Animal Organic and Mineral Fertiliser	192	Wooltana	Wooltana Industries Pty., Ltd.	....	....	4·0	....	..	2·0	7·15	9·15	..	....	£17/2/6 (W) £25/2/6 (P)
5. Nitrogen Phosphoric Anhydride and Potash.														
Summit Growth Fertiliser Tablets	2	Summit	L. M. McLeod	4·1	....	....	....	7·0	1·2	0·1	8·3	12·2	....	Packets
Potato Manure A	28	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	2·50	..	..	13·25	2·25	2·50	18·00	....	5·00	£21/12/3 (W) (P)
Potato Manure B	29	do.	do. do. do.	....	3·50	..	..	12·50	2·00	2·25	16·75	....	5·00	£23 (W) (P)
Potato Manure E	31	do.	do. do. do.	....	3·50	..	....	11·50	2·00	2·00	15·50	....	8·00	£24/5/0 (W) (P)
Orchard Manure	32	do.	do. do. do.	....	3·50	....	.	12·50	2·00	2·25	16·75	....	5·00	£23 (W) (P)
Garden Fertiliser	33	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	....	3·50	....	....	11·50	2·00	2·00	15·50	....	8·00	£25/4/0 (W) (A)
Orchard Manure	34	do.	do. do. do.	..	3·50	....	....	12·50	2·00	2·25	16·75	..	5·00	£23/15/9 (W) (A)
Potato Manure A	47	do.	do. do. do.	..	2·50	....	....	13·25	2·25	2·50	18·00	..	5·00	£22/5/3 (W) (A)
Potato Manure B	48	do.	do. do. do.	..	3·50	..	....	12·50	2·00	2·25	16·75	.	5·00	£23/15/9 (W) (A)
Potato Manure E	50	do.	do. do. do.	..	3·50	..	....	11·50	2·00	2·00	15·50	....	8·00	£25/4/0 (W) (A)
Orchard Manure	51	Sickle	Cuming Smith Mount Lyell	....	3·50	....	..	12·50	2·00	2·25	16·75	....	5·00	£23 (W) (P)
Garden Fertiliser	52	do.	do. do. do.	....	3·50	....	....	11·50	2·00	2·00	15·50	....	8·00	£24/5/0 (W) (P)
Potato Manure A	65	do.	do. do. do.	....	2·50	..	....	13·25	2·25	2·50	18·00	..	5·00	£21/12/3 (W) (P)
Potato Manure B	66	do.	do. do. do.	....	3·50	....	....	12·50	2·00	2·25	16·75	..	5·00	£23 (W) (P)
Potato Manure E	68	do.	do. do. do.	....	3·50	....	....	11·50	2·00	2·00	15·50	....	8·00	£24/5/0 (W) (P)
Orchard Manure	69	"M.L." in diamond	do. do. do.	..	3·50	....	..	12·50	2·00	2·25	16·75	....	5·00	£23 (W) (P)
Garden Fertiliser	70	do.	do. do. do.	....	3·50	..	....	11·50	2·00	2·00	15·50	....	8·00	£24/5/0 (W) (P)
Potato Manure A	78	do.	do. do. do.	..	2·50	..	....	13·25	2·25	2·50	18·00	....	5·00	£21/12/3 (W) (P)
Potato Manure B	79	do.	do. do. do.	..	3·50	....	....	12·50	2·00	2·25	16·75	..	5·00	£23 (W) (P)
Potato Manure E	81	do.	do. do. do.	...	3·50	....	....	11·50	2·00	2·00	15·50	..	8·00	£24/5/0 (W) (P)
Tobacco Fertiliser	82	C.S.M.L.	do. do. do.	.	3·30	..	....	11·50	2·00	2·25	15·75	..	5·70	£25/9/3 (P.J.) (W)
Tomato Manure	84	do.	do. do. do.	. .	3·50	. .	..	10·25	1·50	2·00	13·75	10·00	...	£28/11/3 (G) (W)
Garden Feriliser	85	do.	do. do. do.	..	3·50	.	....	11·50	2·00	2·00	15·50	...	8·00	£24/14/3 (PJ) (W)
Orchard Manure	86	do.	do. do. do.	....	3·50	..	....	12·50	2·00	2·25	16·75	....	5·00	£23/7/9 (PJ) (W)
Potato Manure A	99	do.	do. do. do.	....	2·50	..	..	13·25	2·25	2·50	18·00	5·00	..	£21/18/9 (PJ) (W)
Potato Manure A2	100	do.	do. do. do.	...	2·50	..	..	12·50	2·00	2·25	16·75	...	5·00	£23/9/3 (G) (W)
Potato Manure B	101	do.	do. do. do.	....	3·50	..	..	11·50	2·00	2·00	15·50	..	8·00	£23/7/9 (PJ) (W)
Potato Manure E	103	do.	do. do. do.	..	3·50	..	....	11·50	2·00	2·00	15·50	8·00	..	£24/14/3 (PJ) (W)
Potato Manure E2	104	do.	do. do. do.	.	3·50	..	....	11·50	2·00	2·00	15·50	..	2·0	£27/0/9 (G) (W)
No. 1 Fertiliser	111	Apex	E. J. Fry Pty., Ltd.	..	2·5	2·5	....	3·0	1·5	4·5	9·0	...	2·0	£38 (W) (P)
Lawn Fertiliser	112	do.	do. do.	..	2·5	2·5	..	3·0	1·5	4·5	9·0	....	2·0	£38 (W) (P)

Special Garden Fertiliser	116	Blue Cross	Agricultural Products Co.	....	....	4·0	..	3·0	3·0	6·0	12·0	2·5	....	Packets
Potato Manure A ..	121	do.	do. do. do.	..	2·5	....	..	13·25	2·25	2·50	18·00	..	5·0	Packets
Potato Manure E ..	122	do.	do. do. do.	..	3·5	....	..	11·50	1·25	2·75	15·50	....	8·0	Packets
Bulb-O	129	do.	do. do. do.	..	....	2·25	..	3·0	3·5	3·5	10·0	.	4·50	Packets
Potato Manure B ..	139	Symonds ...	E. Symonds	..	3·50	....	..	12·50	2·00	2·25	16·75	.	5·00	Packets
Potato Manure E ..	140	do. .	....	..	3·50	....	..	11·50	2·00	2·00	15·50	.	8·00	Packets
Lawn Fertiliser	142	do.	do	..	4·25	....	..	4·00	3·50	4·50	12·00	..	3·75	Packets
Potato Manure E	159	David Gray's	David Gray & Co., Ltd.	..	3·50	....	..	11·50	2·00	2·00	15·50	....	8·00	Packets
Superhumas No. 2	173	Dawn	Dawn Fertilisers	..	4·0	....	..	3·0	0·5	6·5	10·0	.	0·5	Packets
Rose Manure	179	Best	William J. Pascoe & Sons	..	5·0	.	.	2·80	1·03	2·10	5·93	3·20	..	Packets
Potato Manure A	180	do. ..	do. do. do.	..	2·50	..	..	13·25	2·25	2·50	18·00	....	5·00	Packets
Potato Manure E	181	do. ...	do. do. do.	..	3·50	..	.	11·50	2·00	2·00	15·50	....	8·00	Packets
Potato Manure	187	P.P.	Picton Produce Pty., Ltd.	..	2·75	....	.	7·50	.	14·00	21·50	..	2·00	£26 (W) (PJ)
Garden Fertiliser	188	do.	do. do. do.	..	2·75	.	.	7·50	.	14·00	21·50	.	2·00	£26 (W) (PJ)
Top Dressing Fertiliser	189	do.	do. do. do.	....	2·75	.	.	7·50	.	14·00	21·50	.	2·00	£26 (W) (PJ)
Orchard Manure ..	190	do.	do. do. do.	....	2·75	..	.	7·50	.	14·00	21·50	.	2·00	£26 (W) (PJ)
Super and Potash No. 1 .	25	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	..	.	14·00	2·50	2·50	19·00	....	9·00	£18/14/9 (W) (P)
Super and Potash No. 2	26	do.	do. do. do.	..	..	..	.	13·50	2·50	2·50	18·50	9·00	....	£20/14/1 (W) (P)
Super and Potash	44	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	..	..	....	.	14·00	2·50	2·50	19·00	....	9·00	£19/5/0 (W) (A)
Do. do.	59	Sickle	Cuming Smith Mount Lyell	....	.	...	....	14·00	2·50	2·50	19·00	...	9·00	£18/14/9 (W) (P)
Do. do.	77	"M.L." in diamond	do. do. do.	..	..	..	..	14·00	2·50	2·50	19·00		9·00	£18/14/9 (W) (P)
Do. do.	96	C.S.M.L.	do. do. do.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£18/19/9 (W) (P)
7. Phosphoric Anhydride and Minor Elements.														
Super and Copper Ore ..	18	Cresco	Cresco Fertiliser (W.A.), Ltd.	..	..	(Cu) 1·00	..	13·00	2·25	3·75	19·00	....	..	£17/11/9 (W) (P)
Super and Manganese	19	do. ..	do. do. do.	....	....	....	..	14·50	2·50	2·50	19·50	.		£26/10/6 (W) (P)
Super and Zinc Oxide	20	do.	do. do. do.	.	(Mn) 3·80	....	. .	16·50	2·75	3·25	22·50	.	.	£15/18/6 (W) (P)
Super and Molybdenum	21	do.	do. do. do.	..	..	.	(Zn) 1·15	17·00	3·00	3·00	23·00	.	..	£16/1/0 (W) (P)
				(Mo) 2 ozs. per bag	5 lb. Cobalt Sulphate to Ton.									
Super and Cobalt	22	do.	do. do. do.	..	..	..	..	17·00	3·00	3·00	23·00	..		£17/2/0 (W) (P)
Super Copper Ore and Zinc Oxide	23	do.	do. do. do.	....	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	.	.	£18/15/0 (W) (P)
Super, Copper, Zinc and Molybdenum	24	do.	do. do. do.	(Mo) 2 ozs. per bag	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50		..	£20/1/0 (W) (P)
Super and Minor Elements	27	do.	do. do. do.	..	(Mn) 2·25	(Cu) 0·80	(Zn) 2·25	11·75	2·50	2·25	16·50	.		£26/11/8 (W) (P)
Super and Copper Ore	38	"A" in diamond	Albany Superphosphate Co. Pty., Ltd.	..	.	(Cu) 1·00	..	13·00	2·25	3·75	19·00	.		£17/11/9 (W) (A)
Super and Zinc	39	do.	do. do. do.	....	.	..	(Zn) 1·15	16·50	2·75	3·25	22·50	.		£15/18/6 (W) (A)
Super, Copper Ore and Zinc	40	do.	do. do. do.	....	..	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50			£18/15/0 (W) (A)
Super, Copper, Zinc and Molybdenum	41	do.	do. do. do.	(Mo) Trace	..	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	.	£20/1/0 (W) (A)
Super and Manganese	42	do.	do. do. do.	....	(Mn) 3·80	....	....	14·50	2·50	2·50	19·50	..	.	£26/10/6 (W) (A)
Super and Molybdenum	43	do.	do. do. do.	(Mo) Trace	..	.		17·00	3·00	3·00	23·00	...		£16/1/0 (W) (A)
Super and Cobalt	45	do.	do. do. do.	(Co) Trace	....	....	....	17·00	3·00	3·00	23·00	....	....	£17/2/0 (W) (A)
Super, Copper, Zinc and Cobalt	46	do.	do. do. do.	(Co) Trace	...	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	..	..	£21/2/0 (W) (A)
Super and Molybdenum	56	Sickle	Cuming Smith Mount Lyell	(Mo) Trace	....	....	.	17·00	3·00	3·00	23·00			£16/1/0 (W) (P)
Super and Cobalt	57	do.	do. do. do.	(Co) Trace	....	....	....	17·00	3·00	3·00	23·00	....	....	£17/2/0 (W) (P)

A denotes Albany. G denotes Geraldton. P denotes Perth. PJ denotes Picton Junction.

FERTILISERS—continued.

Name of Fertiliser.	Reg. No.	Registered Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total.	Sulphate.	Muriate.	
				%	%	%	%	%	%	%	%	%	%	
7. Phosphoric Anhydride and Minor Elements— *continued.*														
Super, Copper, Zinc and Cobalt	58	Sickle	Cuming Smith Mount Lyell	(Co) Trace	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£21/2/0 (W) (P)
Super and Zinc	60	do.	do. do. do.	....	....	....	(Zn) 1·15	16·50	2·75	3·25	22·50	....	....	£15/18/6 (W) (P)
Super and Copper Ore	61	do.	do. do. do.	....	....	(Cu) 1·00	....	13·00	2·25	3·75	19·00	....	....	£17/11/9 (W) (P)
Super, Copper Ore and Zinc	62	do.	do. do. do.	....	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£18/15/0 (W) (P)
Super, Copper, Zinc and Molybdenum	63	do.	do. do. do.	(Mo) Trace	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£20/1/0 (W) (P)
Super and Manganese	64	do.	do. do. do.	...	(Mn) 3·80	....	....	14·50	2·50	2·50	19·50	....	....	£26/10/6 (W) (P)
Super and Copper Ore	74	"M.L." in diamond	do. do. do.	....	....	(Cu) 1·00	....	13·00	2·25	3·75	19·00	....	....	£17/11/9 (W) (P)
Super and Zinc	75	do.	do. do. do.	....	....	....	(Zn) 1·15	16·50	2·75	3·25	22·50	....	....	£15/18/6 (W) (P)
Super, Copper Ore and Zinc	76	do.	do. do. do.	....	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£18/15/0 (W) (P)
Super and Copper Ore	90	C.S.M.L.	do. do. do.	....	....	(Cu) 1·00	....	13·00	2·25	3·75	19·00	....	....	£17/11/9 (W) (P)
Super and Zinc	91	do.	do. do. do.	....	....	....	(Zn) 1·15	16·50	2·75	3·25	22·50	....	....	£15/18/6 (W) (P)
Super, Copper Ore and Zinc	92	do.	do. do. do.	....	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£18/15/0 (W) (P)
Super, Copper, Zinc and Molybdenum	93	do.	do. do. do.	(Mo) Trace	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£20/1/0 (W) (P)
Super and Cobalt	94	do.	do. do. do.	(Co) Trace	....	....	....	17·00	3·00	3·00	23·00	....	....	£17/2/0 (W) (P)
Zinc and Cobalt	95	do.	do. do. do.	(Co) Trace	....	(Cu) 1·00	(Zn) 1·15	12·75	2·25	3·50	18·50	....	....	£21/2/0 (W) (P)
Super and Manganese	97	do.	do. do. do.	....	(Mn) 3·80	....	....	14·50	2·50	2·50	19·50	....	....	£26/10/6 (W) (P)
Super and Molybdenum	98	do.	do. do. do.	(Mo) Trace	....	....	....	17·00	3·00	3·00	23·00	....	....	£16/1/0 (W) (P)
Super and Copper Sulphate	147	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	(Cu) 1·25	....	16·00	2·75	2·75	21·50	....	....	£23/2/6 (W) (P)
8. Nitrogen, Phosphoric Anhydride Potash and Minor Elements.														
Special Mixture 363	15	do.	Cresco Fertilisers (W.A.), Ltd.	...	12·00	(Cu) 0·10	(Zn) 0·30	3·25	0·50	0·50	4·25	....	11·5	£38/7/10 (W) (P)
Tobacco Fertiliser No. 2	83	C.S.M.L.	Cuming Smith Mount Lyell	....	3·30	(Cu) Trace	(Zn) Trace	11·00	2·00	2·00	15·00	....	5·70	£25/19/6 (PJ) (W)
Rose Bush Fertiliser	117	Blue Cross	Agricultural Products Co.	(B) 6 PPM (Mg) 145 PPM	(Mn) 100 PPM	4·0	(Cu) 45 PPM	2·0	2·0	4·0	8·0	3·0	(Zn) 45 PPM (Fe) 160 PPM (Mo) 2 PPM (Al) 45 PPM	Packets

Lawn Manure	118	do.	do. do. do.	(B) 6 PPM (Mg) 145 PPM (Fe) 160 PPM (Al) 250 PPM	(Mn) 100 PPM (Zn) 45 PPM (Al) 45 PPM	4·0	(Cu) 45 PPM	1·0	1·0	6·0	8·0	2·0	(Mo) 2 PPM	Packets
Citrus Manure	119	do.	do. do. do.	(B) 35 PPM (Mg) 750 PPM (Fe) 1,000 PPM	(Mn) 550 PPM (Zn) 250 PPM	5·0	(Cu) 250 PPM	....	5·0	4·0	9·0	3·0	(Mo) 12 PPM	Packets
Rose Manure	113	Apex	E. J. Fry Pty., Ltd.	(B) ·003 (Mg) 0·05	(Mn) 0·02	3·0	(Cu) 0·03	5·0	2·0	6·0	13·0	(Zn) ·015 (Mo) ·005	9·0	£40/10/0 (W)
Boost Crop 1	27	Blue Cross	Agricultural Products Co.	.... (Fe) 320 PPM	.... (Zn) 90 PPM	4·4 (Mg) 275 PPM	.... (Mn) 200 PPM	1·0 (Cu) 90 PPM	2·0 (B) 13 PPM	6·0 (Mo) 4 PPM	9·0 (Al) 90 PPM	....	3·0	£40/10/0 (W) (P)
Fertosol	130	do.	do. do. do.	As Urea 23·0* (Fe) 500 PPM	(Zn) 100 PPM 7·0	5·0	(Mn) 120 PPM	(Cu) 1,000 PPM 16·0	(B) 50 PPM	(Mo) 50 PPM	16·0	8·0	..	£40/10/0 (W) (P)
Cardex	132	do.	do. do. do.	(Fe) 0·5	(Zn) 0·6	(Mg) 0·5	....	(Cu) 0·4	2·0	....	2·0 (Al) 0·4	....	2·5	£40/10/0 (W) (P)
Rose Fertiliser	143	Symonds..	E. Symonds	....	4·25 (Zn) Trace	..	....	4·00 (Cu) Trace	3·50	4·50	12·00	.	3·75	£40/10/0 (W) (P)
Lawn Feed	144	Canning Lawn Service	Canning Lawn Service	....	12·0 (Zn) 0·36	....	....	3·3 (Cu) 0·112	0·7	0·5	4·5	..	11·5	50 lb. bags 28/–.
Rose Manure	145	Clarksons..	Clarksons (W.A.) Pty., Ltd.	(Fe) 0·05	(Zn) 0·05	(Mg) 0·05	(Mn) 0·05	(Cu) 0·05	(B) 0·05	(Mo) 0·05	9·5	(Ca) 3·25	5·0	Packets
Fertiliser	146	do.	do. do. do.	(Fe) 0·05	5·0 (Zn) 0·05	5·0 (Mg) 0·05	(Mn) 0·05	2·4 2·4 (Cu) 0·05	2·4 5·0 (B) 0·05	2·1 2·1 (Mo) 0·05	9·5	(Ca) 3·25	5·0	Packets
Rose Manure	152	David Gray's	David Gray & Co., Ltd.	(Fe) 0·05	(Zn) 0·05	5·0 (Mg) 0·05	(Mn) 0·05	2·4 (Cu) 0·05	5·0 (B) 0·05	2·1 (Mo) 0·05	9·5	(Ca) 3·25	5·0	Packets
Citrus Manure	153	do.	do. do. do.	(Fe) 0·05	(Zn) 0·05	5·0 (Mg) 0·05	(Mn) 0·05	2·4 (Cu) 0·05	5·0 (B) 0·05	2·1 (Mo) 0·05	9·5	(Ca) 3·25	5·0	Packets
Lawn Fertiliser	154	do.	do. do. do.	(Fe) 0·05	(Zn) 0·05	5·0 (Mg) 0·05	(Mn) 0·05	2·4 (Cu) 0·05	5·0 (B) 0·05	2·1 (Mo) 0·05	9·5 0·05	(Ca) 3·25	5·0	Packets
Special Garden Fertiliser	155	do.	do. do. do.	(Fe) 0·05	(Zn) 0·05	5·0 (Mg) 0·05	(Mn) 0·05	2·4 (Cu) 0·05	5·0 (B) 0·05	2·1 (Mo) 0·05	9·5	(Ca) 3·25	5·0	Packets
Complete Plant Food	166	Fosterite....	H. S. Emmerson	(Fe) 320 PPM	4·4 (Zn) 90 PPM	(Mg) 257 PPM	(Mn) Trace	1·0 (Cu) 90 PPM	2·0 (B) 13 PPM	6·0 (Mo) 4 PPM	9·0 (Al) 90 PPM	....	3·0	£57 (P)
Rose Manure	169	Dawn	Dawn Fertilisers	(Fe) Trace	5·25 (Zn) Trace	(Mg) Trace	(Mn) Trace	7·75 (Cu) Trace	1·25 (B) Trace	2·0 (Mo) Trace	11·0	....	3·25	Packets
Seedling Manure	170	do.	do. do.	(Fe) Trace	5·3 (Zn) Trace	(Mg) Trace	(Mn) Trace	8·75 (Cu) Trace	1·25 (B) Trace	1·0 (Mo) Trace	11·0	....	4·4	Packets
Bulb and Corm Manure	171	do.	do. do.	(Fe) Trace	1·9 (Zn) Trace	(Mg) Trace	(Mn) Trace	9·2 (Cu) Trace	1·4 (B) Trace	0·8 (Mo) Trace	11·4	....	9·0	Packets

PJ denotes Picton Junction. P denotes Perth.

Name of Fertiliser.	Reg. No.	Registered Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails. at Perth (P).
				Nitrate. %	Ammonia. %	Blood and Bone. %	Bone Dust. %	Water Soluble. %	Citrate Soluble. %	Acid Soluble. %	Total. %	Sulphate. %	Muriate. %	
8. Nitrogen, Phosphoric Anhydride Potash and Minor Elements—*continued.*														
Super-humus No. 1	172	Dawn	Dawn Fertilisers	(Fe) Trace	2·0 (Zn) Trace	(Mg) Trace	(Mn) Trace	1·8 (Cu) Trace	0·5 (B) Trace	0·2 (Mo) Trace	2·5	....	2·0	Packets
Plant Food	174	do.	do. do.	(Fe) Trace	5·3 (Zn) Trace	(Mg) Trace	(Mn) Trace	7·85 (Cu) Trace	1·15 (B) Trace	2·0 (Mo) Trace	11·0	....	3·5	Packets
9. Trace Elements.														
Minerals	126	Blue Cross	Agricultural Products Co.	(Fe) 4·0	(Zn) 1·0	(Mg) 3·3	(Mn) 2·25	(Cu) 1·0	(B) 0·15	(Mo) 0·05	....	(Al) 1·0	(CaO) 9·0*	Packets
Trace Elements	165	Fosterite....	H. S. Emmerson	(Fe) 4·0	(Zn) 1·0	(Mg) 3·3	(Mn) 2·25	(Cu) 1·0	(B) 0·15	(Mo) 0·05	....	(Al) 1·0	(CaO) 9·0	£117/14/5 (W) (P)
Tracels	175	Dawn	Dawn Fertilisers	(Fe) 37·6	(Zn) 0·2	(Mg) 2·5	(Mn) 2·0	(Cu) 0·9	(B) 0·5	(Mo) 0·2	....	....	....	Packets
Hydrangea Blueing Tonic	131	Blue Cross	Agricultural Products Co.	(Fe) 3·5	(Zn) 2·0	....	2·0	....	....	....	2·0	(Al) 3·2	(S) 8·9	Packets
10. Liquid Fertilisers.														
Concentrated Fertiliser	13	Spring	F. H. Faulding & Co., Ltd.	(Fe) ·02	7·5 (Zn) ·004	....	(Mn) ·02	5·0 (Cu) ·004	(B) ·04	(Mo) ·004	5·0	....	4·0	Bottles
Liquid Fertiliser	125	Blue Cross	Agricultural Products Co.	As Urea 6·5*	....	....	....	5·0	....	....	5·0	3·0	....	Bottles
Liquid Manure	149	Aquasol	Horticultural Industries Pty., Ltd.	As Urea 20·0*	....	(MgO) 0·5	....	12·0	....	....	12·0	16·0	(CaO) 1·3	Bottles
Liquid Fertiliser	156	David Gray's	David Gray & Co., Ltd.	....	9·0	....	....	13·1	....	....	13·1	4·0	....	Bottles
B.—ORGANIC FERTILISER.														
1. Blood and Bone.														
Blood and Bone	1	Yahl	Burridge & Warren Pty., Ltd.	....	....	5·50	....	....	6·00	10·00	16·00	....	....	£29/13/0 (P)
Do. do.	5	Sound	Cockburn Sound Fertilisers	....	....	5·25	....	....	2·50	6·50	9·00	....	....	£32 (W)
Do. do.	7	Wyndham	Wyndham Meatworks	....	....	6·0	....	....	5·5	9·5	15·0	....	....	£32/10/0 (P)
Do. do.	8	"TB&S" in diamond	Thomas Bortherick & Sons A/Asia, Ltd.	....	....	5·75	....	....	6·75	5·25	12·00	....	....	£37/10/0 (W)
Blood and Bone Manure	9	Kitchens....	J. Kitchen & Son Pty., Ltd.	....	....	6·8	....	....	9·0	5·0	14·0	....	....	£40/15/0 (P)
Blood and Bone	110	Apex	E. J. Fry Pty., Ltd.	....	....	6·0	....	....	4·0	11·0	15·0	....	....	£41/10/0 (W)
Blood and Bone Fertiliser	114	Blue Cross	Agricultural Products Co.	....	....	5·0	....	....	3·0	9·0	12·0	....	....	
Blood and Bone	141	Symonds....	E. Symonds	....	....	5·25	....	....	2·50	6·50	9·00	....	....	Packets
Do. do.	150	David Grays	David Gray & Co., Ltd.	....	....	5·0	....	....	2·0	8·0	10·0	....	....	£34 (W) (P)
Elood and Bone Fertiliser	167	Dawn	Dawn Fertilisers	....	....	5·0	....	....	2·0	8·0	10·0	....	....	Packets
Blood and Bone ...	178	Best	William J. Pascoe & Sons	....	....	6·0	....	....	4·0	11·0	15·0	....	....	Packets
Do. do.	186	P.P.	Picton Produce Pty., Ltd.	....	....	5·0	....	....	5·0	10·0	15·0	....	....	£36 (W) (PJ)
Do. do.	191	Wooltana	Wooltana Industries Pty., Ltd.	....	....	5·0	....	....	2·0	7·15	9·15	....	....	£33 (P)
Do. do.	193	Wesfarmers	Westralian Farmers Co-op., Ltd.	....	....	5·0	....	....	2·0	7·15	9·15	....	....	£30 (P)
Do. do.	194	do.	do. do. do.	....	....	5·0	....	....	2·0	7·15	9·15	....	....	£33 (P)

2. Animal Fertilisers.														
Animal Fertilisers	115	Blue Cross	Agricultural Products Co.	....	....	3·5	....	...	3·0	9·0	12·0	....	....	Packages
Do. do. do.	177	A.N.A. Surprise	E. J. Fry Pty., Ltd.	....	....	5·0	....	....	4·0	10·0	14·0	....	....	£47/10/0 (P)
3. Blood Meal Fertilisers.														
Dried Blood	195	Wesfarmers	Westralian Farmers Co-op., Ltd.	....	....	12·0	....	....	....	....	....	....	....	£80 (P)
4. Fish Fertilisers.														
Cray Meal	3	Sound	Cockburn Sound Fertilisers	....	....	5·50	....	....	....	....	....	....	....	£29 (W)
Fish Fertiliser	6	do.	do. do. do.	....	....	4·5	....	....	2·0	6·0	8·0	....	....	£28 (W)
Special Fish Manure	148	Blue Cross	Agricultural Products Co.	....	....	3·5	....	....	....	....	7·5	....	....	
Fish and Bone Manure	151	David Gray's	David Gray & Co., Ltd.	....	....	4·0	....	....	3·0	4·0	7·0	....	....	£2/8/0 cwt. (W)
C.—AGRICULTURAL LIME.														
Garden Lime	133	Blue Cross	Agricultural Products Co.	(Neutralising Value, 75%), (40% in form of Calcium Carbonate), (75% Equivalent to Calcium Carbonate).										
Do.	164	David Gray's	David Gray & Co., Ltd.	(Neutralising Value, 75%).										
Do.	176	Dawn	Dawn Fertilisers	(Neutralising Value, 75%).										
Garden Lime	185	Best	William J. Pascoe & Sons	(Neutralising Value 75%).										

P denotes Perth. PJ denotes Picton Junction.

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Water and dirt stay home on land you've subsoiled the Cat Tool Bar Way!* Walk out on your fields during a heavy rain. Look. Listen: is the water running off the slopes . . . the same hills that dry out in summer? Or do those puddles stay on the top? Either case, you'll trap the water and make it soak in faster the Cat Tool Bar Way! Store water in the subsoil for future use. Get the water off the top so you can work the the land. You *will* with a Cat Diesel Tractor and Tool Bar! We'll prove it.

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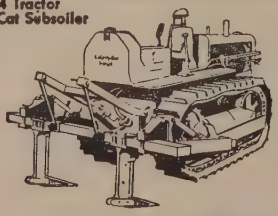

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MINERALS FOR LIVESTOCK—

Why Buy "Shot-Gun" Licks?

By L. C. SNOOK, D.Sc.,
Animal Nutrition Officer.

COMMERCIAL stock licks can contain a great variety of minerals, and the labels, as a result, often list an array of ingredients which can appear quite impressive. It is important, therefore, that the farmer should be able to tell which of these ingredients, if any, are of any value to his livestock. In most cases only one or two supplementary minerals are required on a farm, so that if a lick contains a large number of minerals most of these are wasted. For example, in most coastal areas a cobalt supplement is needed by sheep and cattle. The farmer, in this case should buy cobalt and not a compound lick which contains many other things. One does not buy a suite of furniture when all that is required is a chair.

Not only is it necessary to know the constituents which are required by the stock—one should also check on the quantities which are present. Some licks have been described as "phosphatic licks" when they have contained only a little phosphate and a lot of common salt. Considerable quantities of salt are sold at fancy prices in the form of stock licks, so always check the amount of salt which is present before making a purchase. And beware of "tricks" of the type employed by the manufacturer of one lick which was advertised as containing 30 per cent. chloride and 45 per cent. sodium when it would have been much simpler (and more honest) to have stated that the lick contained 75 per cent. common salt (sodium chloride).

In order to make the farmer more discriminating when purchasing or preparing stock licks, the following brief comments have been made concerning ingredients which may be included.

COMMON SALT

Common salt is the basis of most mineral licks. It is used because it may be valuable in its own right, but more often because it is a cheap and convenient vehicle through which to feed the so-called trace elements. From time immemorial, salt has been considered necessary to grazing animals, and many farmers still go to considerable expense and trouble to make it available to their stock.

It is now known that sheep, in particular, will eat large quantities of salt, not necessarily because it is of any value to them, but merely because they like salt, just as kiddies like sweets. Quite a few experiments have been carried out in various parts of Australia to determine if common salt is of any value to sheep. In Table I are recorded the results of an experiment carried out in New South Wales (McClymont and Savage, 1950) which shows clearly that sheep can eat considerable quantities of salt without showing any apparent benefit.

TABLE I

Dorset Horn Weaner Rams	Average Initial Weight	Average Final Weight	Average Gain in 307 days	Lick Eaten
	lb.	lb.	lb.	lb.
Control Group	84	166	82	0
Given Salt Lick	86	168	82	240
Given Salt plus Ground Limestone	86	165	79	396

On the basis of such results, official recommendations have been against the feeding of salt to sheep. The flocks on the research stations in Western Australia do not receive any salt and there is no reason to suspect that the returns have been decreased in any way because of this. It has been argued that salt stimulates the appetite and increases the digestive efficiency of sheep on harsh dry feed. Possibly this is correct but there is not experimental evidence to justify the feeding of salt to sheep if this is in any way costly or laborious.

At times it is necessary to supply salt to dairy cattle (1 to 2 oz. per head daily) and to pigs (1 lb. in each 200 pounds of grain) but the quantities are relatively small and do not justify the purchase of a large amount of common salt in commercial compound licks. If salt as such is needed, it is cheaper to buy ordinary stock salt and use it according to Departmental recommendations.

CALCIUM OR "LIME" (Ca)

Calcium is a major constituent of bone and it also plays an important part in many bodily processess. Many stockmen still believe that additional lime is needed if animals are to develop sound bone and large frames. In Western Australia, however, most of the pastures supply sufficient lime. Leguminous herbage in particular is rich in lime and where sub-clover, trefoil, lucerne and similar plants are available in reasonable quantity there should be no need to fear a lime deficiency in grazing animals.

Cereal grains and cereal hays, in contrast, contain very little calcium. It may be thought, therefore, that calcium supplements would be needed in Eastern Wheatbelt areas where stock have to subsist for many months on a predominantly cereal diet. Fortunately, such does not appear to be the case as no clinical evidence of calcium deficiency has been reported. In fact, sheep from these areas have a reputation for large frames and sound teeth.

Milk fever in cows and hypocalcaemia in sheep occur when the amount of calcium in the blood falls below a critical level. These conditions, however, are not due to a lack of calcium in the diet but to a temporary upset in the mechanism which controls the level of calcium in the blood. As far as we know, the feeding of extra lime will not prevent the occurrence of these diseases.

Calcium deficiency is most likely to be seen in livestock which are kept in a confined area and which receive specialsed diets. For example, pigs kept in pens and fed mainly on grain require additional lime (1 per cent. ground limestone in the grain). Laying hens, likewise need plenty of calcium. Where calcium supplements are needed, however, the obvious thing to do is to buy this in the cheapest form, that is, purchase ground limestone or oyster flour and use this as recommended by the Department of Agriculture.

PHOSPHORUS (P)

Phosphorus is needed in considerable amounts by growing and lactating animals and if the diet is deficient in this essential the consequences can be serious. Most soils in Western Ausralia are deficient in available phosphorus and, even when this has been corrected by continued topdressing, the dry mature herbage available over the summer months rarely contains enough phosphorus for the well-being of grazing animals. Experiments which have continued for seven years at the Bramley Research Station have shown conclusively that phosphatic supplements are essential for the maintenance in dairy cows of high production and regular reproduction. The methods of using these supplements will be described in detail in a subsequent Journal article.

If a mineral lick is purchased to supply phosphorus care should be taken to ensure that a worthwhile amount of this element is present. I have before me the analyses of one proprietary lick which contains "Phosphorus (P_2O_5)—1.3 per cent." This amount is hardly worth a mention; bran for example, contains more phosphorus than this. When needed, buy a straight out phosphatic supplement such as bonemeal (12 per cent. P = 28 per cent. P_2O_5) or ground rock phosphate (17 per cent. P = 39 per cent. P_2O_5) or use the water soluble fraction in superphosphate.

MAGNESIUM (Mg.)

This is often listed as an ingredient of mineral licks. Plant material contains about 0.5 per cent. Mg. while there is only about 0.04 per cent. in the bodies of animals. Obviously it is most unlikely that grazing animals will need additional magnesium. Magnesium sulphate or Epsom salts can at times serve a useful purpose but it seems pointless to add magnesium to a mineral lick.

POTASSIUM (K)

Plant material is rich in potassium and there is no need to add potash to a mineral lick.

SULPHUR (S)

Elementary sulphur ("flowers of sulphur") has been used in some proprietary licks for many years. Claims are made that this sulphur is of medicinal value and also that it helps in the building up of the sulphur-containing amino acids required for wool growth. There is no evidence, however, that stock on normal rations will benefit from additional sulphur or from sulphates. The dry matter of good pasture should contain about 0.3 per cent. S. It has been shown experimentally that breeding ewes need only 0.1 per cent. S in the dry matter consumed for the efficient production of meat and wool (F. Whiting *et al.* 1954).

IRON (Fe)

Most of us have heard tales concerning the value of iron tonics, and on the strength of these tales, "tonic" mineral licks are sold at a high price. Normal diets contain plenty of iron and it is most unlikely that stock will benefit from any addition. In the past, licks containing "iron" have appeared to be beneficial but this was because the iron salts contained trace elements which were needed. For example, iron ore (limonite) was found to cure Denmark Wasting Disease but this was because limonite contains cobalt: it was lack of cobalt which caused the disease and not lack of iron.

COPPER (Cu)

Copper deficiency was once a serious problem over large areas of Western Australia and stock licks containing copper can be of great value. Copper, however, is an essential plant nutrient and good pasture cannot be grown on copper-deficient soil. It follows that copper where practicable should be used as a fertiliser where the soil is deficient. If the pasture is healthy this will supply all the copper needed by the animal. In pastoral areas and on coastal country where top-dressing would be uneconomic, it may be necessary to use licks containing copper or to add copper to the drinking water. Here again, if copper is needed it seems preferable to buy bluestone as such and use it in one of the ways recommended by Dr. H. W. Bennetts in the January-February issue of the Journal of Agriculture (Bulletin No. 2227). Denmark Lick also, is a cheap and convenient source of copper for livestock.

COBALT (Co)

Generally, in coastal areas cobalt supplements are essential for sheep and cattle. The farmer must decide just how to supply this cobalt. Full details can be obtained in Departmental Bulletin No. 2172. The required cobalt can be supplied at little cost in the form of commercial cobalt salts, or Denmark Lick. Superphosphate containing cobalt can also be applied to the land—cobalt is not a plant food but, if it is present in the soil, sufficient gets into the plant "by accident" to correct cobalt deficiency.

Boom sprays can be used to apply cobalt salts to the soil along with the insecticide solutions used in the control of red mite or lucerne flea. A dressing of 4-6 oz. of commercial cobalt sulphate or cobalt chloride per acre should ensure an adequate intake of cobalt by the stock for two or three years.

IODINE (I)

In those areas of the world where the soils are deficient in iodine, iodised salt licks have proved of great value. There is no evidence, however, that livestick in Western Australia suffer from lack of iodine. The symptoms seen in iodine deficiency are very characteristic and until these symptoms have been reported and confirmed, there is no point in buying a stock lick because it contains iodine.

MANGANESE (Mn)

Manganese is often listed among the constituents present in stock licks. As far as is known, this is likely to be required only by young chickens on specialised rations. Periodically, reports are received from overseas which suggest that various diseases may result from a lack of manganese. Pending further study, therefore, it would be foolish to dismiss claims that manganese can be beneficial but at present there is little to indicate that additional managanèse is needed under field conditions in Western Australia. The requirements of the plant are much greater

than those of the animal and therefore stock at pasture do not need supplementation.

ZINC (Zn)

In many areas, crops and pastures have responded to manurial treatment with zinc. This has given rise to the misconception that zinc may be of value to animals also. Even on zinc-deficient soils, the plants contain more than enough zinc for the grazing animals. In other words, although lack of zinc may limit the growth of pasture and the carrying capacity of the farm, such pasture as does grow will contain ample zinc for livestock.

GENERAL

Stock owners in Western Australia are very "mineral conscious." In an endeavour to correct possible deficiencies, there is a tendency to buy small amounts of a lot of things instead of concentrating on known shortcomings. From the comments which have been made in this article it is apparent that the supplementary feeding of minerals can be restricted to two, or perhaps three, constituents. Of course, much remains to be learnt concerning the mineral requirements of animals and it is possible that new knowledge may result in adidtions to the list of minerals which are required in stock licks. For the present, however, it seems that supplementary feeding can be simple and straightforward. The advocates of compound or "shot-gun" licks claim that it costs very little to put in "everything" so this is done "just in case." The extra ingredients must cost something, however, and when compound licks are used there is a tendency to skimp the main essential. To me it seems preferable to determine what is needed in a given district and to concentrate on supplying this in adequate amounts.

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* * * *

RESEARCH IN MULGA AREAS

A programme of pastoral research was commenced this year in the mulga areas. A research officer and a technician now resident in the Lake Way Hotel, purchased by the Government last year to provide accommodation for research and technical staff, will devote the whole of their time to a series of field trials to be carried out in co-operation with pastoralists in the Wiluna and Meekatharra districts.

At the Wiluna end, the Howard Bros., of Albion Downs, have been particularly helpful in providing country, fencing and labour for trials concerning the nutritional value of mulga, and the effect of thinning a stand of mulga which had grown too tall to be of much grazing value.

At Meekatharra, Mr. E. Lee Steere, of Belele Station, will be assisting with trials concerning possible methods of regenerating country which formerly carried a variety of sheep feeds but has become progressively taken over by less desirable species or left to bare windblown surface.

Mr. White, of Yarrabubba, is co-operating with a grazing and management trial on saltbush and bluebush country.

If the trials should be attended by anything like the success achieved with this class of work in the Port Hedland areas, as evidenced by the recent field day at Munda, it will mean a great deal to the pastoral industry.

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TRACTORS CAN KILL!

PROPERLY handled, the modern tractor is the farmer's best friend. It provides an ample reserve of power in a reasonably small compass—power that is easily controlled, highly mobile and capable of being readily applied to many tasks. Carelessly handled, the same tractor can become a menace to life and limb.

In recent years there has been a marked increase in tractor-caused fatalities throughout Australia, as well as in non-fatal accidents resulting in serious injuries and material damage.

Most of these accidents could have been prevented by observing simple common-sense precautions.

There is nothing unpredictable about a tractor as there is in the case of a vicious horse or bull. Tractor accidents are caused by human carelessness—by taking chances which should never have been taken.

Read this article carefully and check on the number of times that **YOU** have taken risks which could lead to tragedies.

AVOID FIRE RISKS

Tractors run on inflammable fuel—always remember the ever-present risk of explosions and fire. Keep naked lights away while handling fuel.

Don't smoke while re-fuelling; never refuel with the engine running or when the exhaust pipe is still very hot; if re-fuelling with cans, keep them well clear of battery terminals where a spark could trigger off an explosion.

Admittedly, hundreds of people have disregarded these precautions and are still alive, but many others have been less fortunate. Why run the risk of a horrible death or lifelong disfigurement through lack of simple precautions?

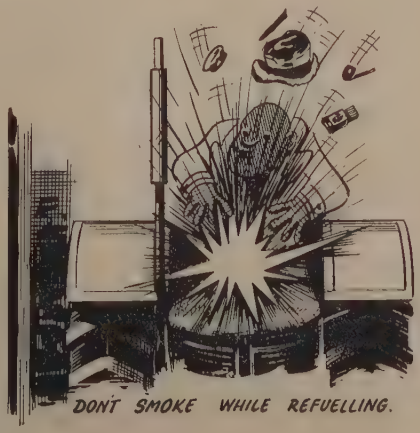
Avoid spillage of fuel. Even a normally careful person might strike a match near ground or material soaked with highly inflammable fuel.

Have fully-charged fire extinguishers handy at all times and use efficient spark arrestors to reduce the risk of crop fires.

SERVICING

Take special care if making adjustments which can only be made with the engine running. Avoid loose flapping clothing which could become entangled in moving parts.

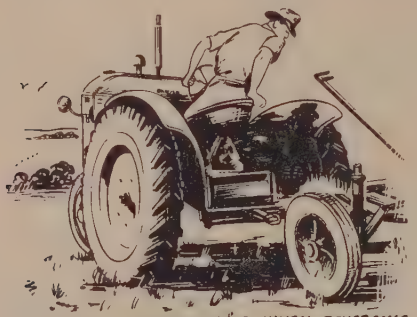
Chock the wheels before jacking up tractors or implements and don't rely on the jacks alone if you have to crawl under the machine. It doesn't take long to put some packing under as a safety precaution.



Use care in removing the radiator cap if a pressurised cooling system is used, or if the engine is overheated.

STARTING

Because of its powerful engine and low gear ratio, a moving tractor is an almost irresistible force. **Never take a chance on it moving unless you are in a position to exercise prompt and complete control.**



REMAIN ON TRACTOR SEAT, WHEN REVERSING TO ATTACH IMPLEMENT.

Place all controls, gear levers and power take-off in the neutral position before starting the engine.

Use self-starter from the seat. If necessary to crank by hand, pull the handle up, keeping the thumb on the same side of the handle as the fingers. This will reduce the chances of a backfire causing a broken wrist.

Remain on the seat when backing the tractor towards the implement to be attached. Never try to work the clutch when off the tractor.

Fit attachments correctly and avoid makeshift hitches. Use the drawbar in the manufacturer's position or use the recommended three-point linkage.

When using power-drive implements make sure that moving parts are correctly shielded to avoid accidental contact.

NO PASSENGERS

Except for a few special models, the tractor is a one-man machine. Even when travelling on smooth ground it is not easy for a second passenger to find a safe place to sit or stand. On rough ground there is a grave risk of a passenger falling off the machine.

Keep children off tractors and away from tractor-operated machinery. A very large precentage of tractor-caused fatalities are children.

Driving a tractor and taking care of children are each full-time jobs—no man can do both simultaneously.

Use special care when reversing, and make sure that your vision is not obscured, especially if there is a chance of children being in the vicinity.

TRACTORS CAN ROLL OVER

Tractors and motor-cars have many points in common but because it is designed to work on rough ground or for row-crop work a tractor has more ground clearance than a car or truck.

This means that the centre of gravity is higher which, in turn, means that the tractor can overturn more easily. The centre of gravity on crawler tractors is usually somewhat lower than on wheel tractors but **all** tractors demand special care when being operated on sloping ground.

Tractor wheels should be set as wide as possible when working on hillsides and dual rear wheels which increase the overall width of the machine are an aid to greater lateral stability.

When one-way ploughing on hillsides, throw the soil uphill so that the uppermost wheels are in the furrow. Always watch for holes, rocks or stumps which could cause the tractor to tilt sideways—special care is needed when turning.

Keep the speed down when working on slopes or rough ground.

KEEP CHILDREN OFF TRACTORS & AWAY FROM TRACTOR-OPERATED MACHINERY.

Keep clear of ditches or depressions where crumbling edges could cause the tractor to tilt sideways. Always cross ditches at right angles and engage the clutch gently when pulling out of ditches or going uphill. Make sure that the clutch can be disengaged promptly if the tractor commences to "rear-up."

Braking.

Most tractors have independent rear wheel brakes to facilitate turning on headlands. See that the brakes are evenly adjusted as uneven braking can cause a "roll-over."

When operating in high gear use both brakes simultaneously. Most tractors have a latch to interlock both pedals and this should always be in use in high gears. The application of one brake can cause the tractor to swerve sharply and turn over if travelling quickly. **Always remember that the danger of overturning increases four times when the speed is doubled.**

REARING

Many deaths have been caused by wheeled tractors "rearing-up" and falling over backwards, crushing the driver.

Such accidents occur most easily when ascending steep hills, but may be caused by any check to the forward movement of the tractor such as occurs when the towed implement wedges under a tree-root or rock.

Unless the clutch is promptly disengaged, the engine winds itself upward, pivoting on the rear axle and lifting the front of the tractor off the ground.

The driver must be in a position to declutch promptly at the least check to forward progress.

To further reduce the risk of rearing or rolling over: Always engage the clutch gently when moving off with a heavy load. Never "snatch" at the load.

Do not use a wheeled tractor for direct pulling out of trees and stumps. Use with block and tackle or a winch.

Pull from the maker's towbar only and do not alter the positioning. Makeshift hitches are dangerous.

When pulling in reverse, use the front towing hook.

When descending hills, never allow the tractor to "coast". Always engage a gear to act as a brake, using a low gear on a steep slope. Have independent brakes, wherever possible, on towed equipment to prevent "jack-knifing."

STOPPING AND PARKING

In making an emergency stop, close the throttle, brake both wheels simultaneously and don't bother about the clutch.

BEWARE OF EXPOSED SHAFTS AND LOOSE OR FLAPPING CLOTHING.

When making a normal stop always apply the brakes and lower the blades, scoop bowls or other attachments before leaving the machine. Remove ignition or starter keys if leaving the unit.

Never dismount from a moving tractor. Apply the parking brakes first. If you must dismount while the engine is running, always make sure that the transmission gearshift lever is in the neutral position. Where a flywheel master clutch (hand lever operated) is fitted, see that it is positively engaged.

Always remember that diesel engines, when in gear, have been known to start on slight movement of the tractor.

TREE-CLEARING AND EARTH-MOVING

When using tractors for tree-dozing, make sure that there is an adequate protective canopy fitted, and beware of trees with dry heads or dead branches. Even a strong canopy has it limits.

Stop the engine before adjusting winches and power control units.

Always chock up dozer-blades or scoop bowls before fitting new cutting edges. Chock tailgate before attempting to remove obstructions from scoop bowls.

Do not leave loose wires or cables on machines. Wind loose ends on to their respective units or drums and tie securely.

STATIONARY WORK

Never run the engine in a closed shed. Carbon monoxide from the exhaust gases cannot be seen or smelt but can kill rapidly.

See that the tractor is well grounded and safely chocked before using it for belt work.

Operate the clutch and power take-off from the tractor seat only.

Do not put on or remove the belt while the pulley is in motion.

Keep moving parts well shielded and do not wear loose flapping clothing which could catch in revolving belts or shafts.

Keep the exhaust pipe well clear of inflammable material.

USE COMMONSENSE

At first sight this may appear to be a somewhat formidable array of safety measures to observe, but in reality they are all simple commonsense approaches to everyday farm tasks.

None of them requires elaborate equipment or arduous labour—none of them demands any marked changes in the normal routine—yet their general observance would result in an immediate reduction in the farm casualty list.

Tractor accidents don't just occur—they are caused—usually by carelessness. When a tractor becomes a killer, it only does so because somebody, somewhere, has done the wrong thing—or failed to do the right thing.

Make sure that that **SOMEBODY** will never be **YOU.**

(Compiled from material supplied by the National Safety Council of Australia.)

Book Review

A CITRUS GROWERS' HANDBOOK

"Citrus Growing in Australia," by Frank T. Bowman, Principal Research Officer of the Department of Agriculture, New South Wales, is a book which will fill an important gap in the available literature on fruit growing under Australian conditions. It is written in a manner easily assimilated by the orchardist, but at the same time, contains sufficient technical data to be valuable to students and extension officers.

The whole subject of citrus growing from the selection of suitable land, its preparation and planting, right through to the harvesting and marketing of the crop is dealt with in considerable detail and the orchardist will find it a very valuable reference for answers to his various problems. Considerable attention is given to varieties of citrus fruits, problems associated with various rootstocks and methods of tree propagation. Nutrition, soil management, drainage and irrigation also come within the orbit of the discussion, while an up-to-date section on the control of citrus pests and diseases is included.

Although much of the information refers to conditions pertaining in New South Wales, the basic principles are readily applied to other parts of Australia and sufficient reference is made to growing conditions elsewhere to enable a grower to apply the recommendations to his own circumstances.

This is a book well worth its place in any citrus grower's library.—F.M.

("Citrus Growing in Australia," by Frank T. Bowman, Ph.D., B.Sc. (Agric.), H.D.A. Published by Angus & Robertson, Sydney. Price 63s.)

LIBRARY SERVICE OF W.A.

BOOKS... *for FARMERS*

THE following books on agriculture, recently published and obtainable to order from most booksellers, have been added to the stock of the Library Board of Western Australia, and may be borrowed freely from any public library associated with the Board, or consulted at the State Library of Western Australia.

GENERAL

GROWING MUSHROOMS, by R. Genders. 3rd ed. Lond., 1956.

AN INTRODUCTION TO STATISTICAL SCIENCE IN AGRICULTURE, by D. J. Finney. Copenhagen, 1953.

AGRICULTURAL MACHINERY

DIRECTORY OF WHEEL AND CRAWLER TRACTORS PRODUCED THROUGHOUT THE WORLD, 1955. Food and Agriculture Organisation of the United Nations. [Rome], 1955.

YEAR BOOK, 1955-56. Institution of British Agricultural Engineers. Brighton (Sussex), 1955.

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CORN AND ITS EARLY FATHERS, by H. A. Wallace and W. L. Brown. [East Lansing], 1956.

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BIOLOGY OF ROOT-INFECTING FUNGI, by S. D. Garrett. Cambridge, 1956.

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BRITISH FRIESIANS: A HISTORY OF THE BREED, by J. K. Stanford. Lond., 1956.

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A DICTIONARY OF DAIRYING, by J. G. Davis. 2nd ed. Lond., 1955.

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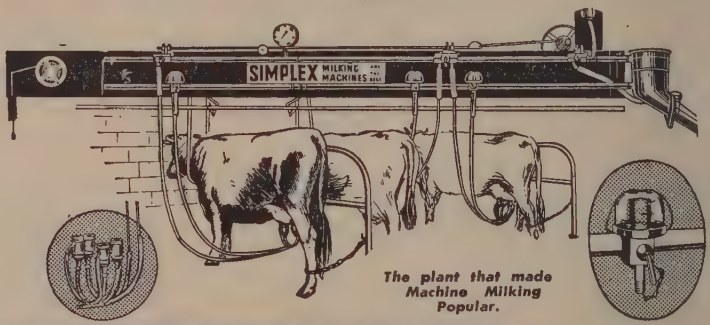

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Western Australia again leads the Commonwealth

By N. DAVENPORT, B.Sc. (Agric.) Senior Adviser, Meat Production.

A WEST AUSTRALIAN lamb breeder, Mr. R. S. Wallace, of Mt. Barker, gained first place with his entry of five lambs in the West Australian Export Lamb Carcass Competition for 1956. Later this winning entry was awarded the All Australian Championship when competition carcasses from all States were judged at Smithfield by Mr. E. F. Way, a highly qualified and experienced member of the London Meat Trade. The Western Australian team of the four leading pens was also judged to be superior to the teams entered by the other lamb producing States and thus won the Interstate Competition.

The All Australian Competition has been conducted for five years. Lamb carcasses from this state have now been successful in both the All Australian Championship and the Interstate Competition for three (1952, 1953 and 1956) of the five years. For the first two years the All Australian Championship was won by Mr. M. K. Reynolds of Meckering.

Western Australia can feel justly proud of its continued success in this competition. These results must give further impetus to an important industry and also provide an incentive to growers to take part in the competition, quite apart from the high value of the prizes given.

State-wide competitions for export lamb carcasses were first conducted by the Australian Meat Board in this and other lamb-producing states in 1937. The competitions were interrupted by the war but were resumed in 1948 and have been held every year since.

The principal objects of the competition have been to foster the production of high quality lamb suitable for the English market and to keep buyers aware of the high quality of lambs from Australia. After each killing season, all lambs entered and accepted for competition have been shipped to England where they were the subject of a special advertising display made on a state basis at the Smithfield Meat Market.

STATE COMPETITIONS

Since 1948, inclusive, the competition has been for two classes of lamb:—

Class 1 for lambs sired by Southdown rams.

Class 2 for lambs sired by rams of any other British breed.

For each class the ewes must not be entirely of British breed blood, in other words they must not be of one British breed nor of a cross between two British breeds but may be crossbreds, comebacks, Corriedales, Polwarths or Merinos. The rams must be flock rams from flocks registered in the recognised flock books. Lambs must be bred by the entrant.

The restriction of Class 1 to lambs sired by Southdown rams recognises the superiority of this breed in producing the highest quality lambs. The lambs of practically all the entrants are out of half bred longwool-Merino ewes as these have been found to be the most satisfactory producers of export carcasses.

In order that the lambs should be competing under reasonably similar conditions of production, the agricultural districts are divided into zones for Class 1 as follows:—

Zone 1 consisting of the Northern and Eastern Districts.

Zone 2 consisting of the Midlands District.

Zone 3 consisting of the Central and Great Southern Districts.

Zone 4 consisting of the lower Great Southern and South-West Districts.

Entrants in each zone compete for the Zone Competition except that zones 1 and 2 are now judged as one competition. The first and second prizewinners then compete for the State Championship which carries a prize of £30 and a trophy valued at £15. A prize of £10 is awarded to the Reserve Champion.

Prizes are given for each of the Zone Competitions. In Class 1 they are for first £13, second £7, and third £4, and for Class 2 the prizes are £13, £7, and £3 respectively.

ALL AUSTRALIAN COMPETITION

In 1952 it was decided to conduct a competition on a Commonwealth basis for all lambs forwarded to London in the various State Competitions. Two awards are made. One is the All Australian Championship for the best individual entry and the other is the Interstate Championship awarded to the State with the best group entry.

INTERSTATE COMPETITION

The four leading entrants in each State Competition are regarded as the entry for that State in the Interstate Competition for which the prize is a trophy valued at £50 for perpetual competition. This trophy is held by the Department of Agriculture in the winning State for one year.

Prizes in addition to those won in the State Competition are given and these are £10 for first, £5 for second, £3 for third, and £2 for fourth placings.

This State's entrants again showed up to advantage. The Western Australian entry won the Interstate Competition for the third time in five years and now holds the trophy until the results of the next competition are announced.

The four entrants comprising the winning team are given below together with their points scored.

First—

R. S. Wallace, Mount Barker (Southdown x Romney Marsh-Merino), 433 points.

Second—

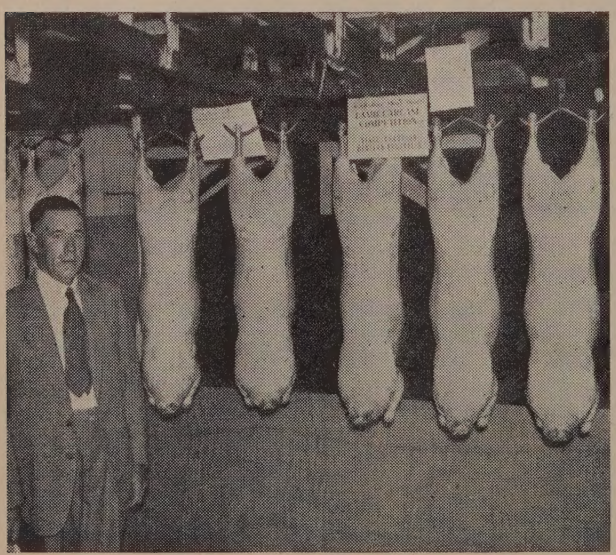
Daliak Estate, York (Southdown x English Leicester-Merino), 424 points.

Third—

S. Wallace, Mount Barker (Southdown x Romney Marsh-Merino), 421 points.

Fourth—

O. E. W. Bruns, Armadale (Southdown x Romney Marsh-Merino), 419 points.



Mr. R. S. Wallace with his prizewinning entry. The lambs were sired by Southdown rams out of Romney Marsh-Merino crossbred ewes, and had an average carcass weight of 36.6 lb.

This gave a total of 1,697 points for Western Australia. Victoria followed with 1,677 points and next in order were Tasmania 1,674 points, New South Wales 1,664 points, South Australia 1,634 points and Queensland 1,628 points.

The members of the other two successful Western Australian teams in 1952 and 1953 were as follows:—

1952—

M. K. Reynolds, Meckering.
J. P. Reynolds, Meckering.
A. N. Rischbeith, Mt. Barker.
M. K. Reynolds, Meckering.

1953—

M. K. Reynolds, Meckering.
W. G. Burges, York.
Muresk Agricultural College, Muresk.
Chapman Research Station, via Geraldton.

ALL AUSTRALIAN CHAMPIONSHIP

The highest scoring entry in the Western Australian team, that of Mr. R. S. Wallace and which scored 433 points, gained the All Australian Championship. It was closely followed by that of E. F. Hancock of Warracknabeal, Victoria, with 425 points.

The judge referred to the Western Australian exhibits as:—

> Easily one of the finest entries ever made from this State. It would be fair to say that lambs from this State have never reached such a high standard since the Competition commenced.

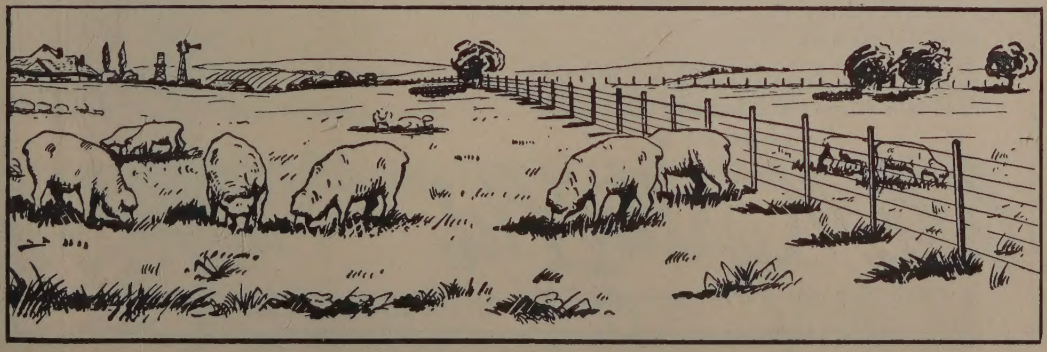
The report on R. S. Wallace's winning entry said:—

> This pen was outstanding, of good conformation, well muscled, with excellent fat distribution and light interior suets, ideal retail meat.

These competitions relate essentially to the requirements of the meat trade. The carcasses are judged according to quality and suitability to the U.K. market. The results are thus of considerable value to breeders to acquaint them with the type of lamb required for export.

It is interesting to note that the winning team last year and of the two previous years were comprised of breeders from very widely divergent areas, ranging from the Geraldton district in the extreme north of the lamb belt to Mt. Barker, adjacent to the southern coast. It is obvious therefore, that the whole of our lamb producing areas are well suited to the production of the type of high quality lamb in demand at Smithfield.

It is also noteworthy that two of the members of last year's team are of the Mt. Barker district, which is particularly important in view of the very considerable land development which is taking place in the agricultural areas adjacent to the southern coast.



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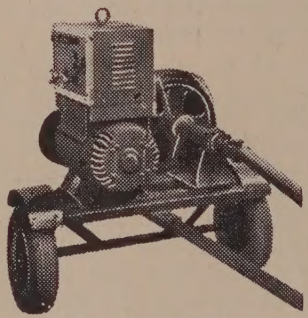

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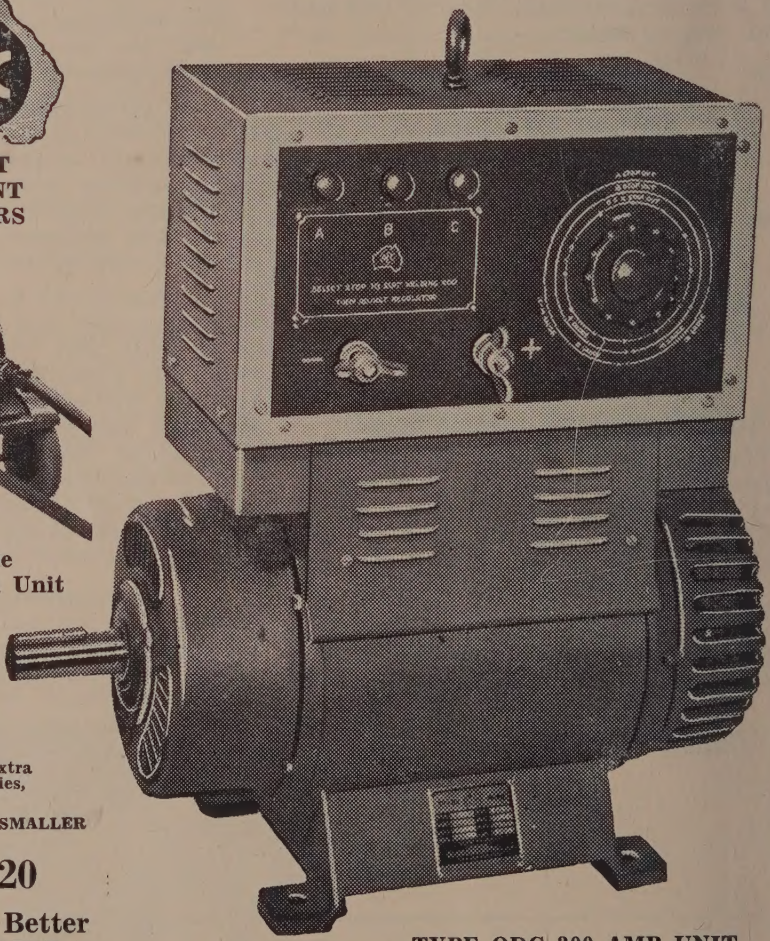

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